The American Gas Light Association and its several members are indebted to the courtesy of the *American Gas Light Journal* for Stenographic Reports of the proceedings of the Association, gratuitously furnished for publication in this volume.

WM. HENRY WHITE,
Secretary.

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SEVENTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION,

HELD AT PHILADELPHIA, OCTOBER 15TH, 16TH AND 17TH, 1879.

The Association met at 10 A. M., and was called to order by Mr. Price, First Vice-President.

THE PRESIDENT—*Gentlemen of the Association:* The time has arrived for opening the Seventh Annual Meeting of this Association. It is unfortunate that we are deprived of the services of our honored President, Gen. Roome, and that I am compelled to occupy the position which he would have filled so much more satisfactorily. I shall, however, discharge the duties of presiding officer to the best of my ability, and trust that I shall receive from you all the assistance which it is in your power to render. Without further preliminary remarks, we will enter at once upon the business of the meeting.

The first thing in order is the reading of the minutes of the meeting of last year.

CAPT. WHITE—I move that the reading of the minutes of last year be dispensed with, as they are already in print.

Carried.

THE PRESIDENT—The next business in order is the reading of applications, notices, and reports for new memberships.

MR. NEAL—We will be ready in a few moments to make our report.

CAPT. WHITE—As the Committee on New Memberships are not yet ready to report, I desire to make the motion that

a committee be appointed by the Chair to prepare and forward to Gen. Hickenlooper, of Cincinnati, a telegram conveying the sincere congratulations of the members of this Association upon his election to the office of Lieutenant-Governor of Ohio. Of course, this motion has no political significance. He is an old and active member of the Association, and every gentleman here who was present at the meeting in Cincinnati will bear witness to the hospitality and courtesy we received at his hands upon that occasion; and I think, in view of his past relation to this Association, it is eminently fitting that we should express to him our sincere congratulations. I therefore move you, sir, that a committee be appointed by the Chair to telegraph the congratulations of this Association to Gen. Hickenlooper.

THE PRESIDENT—It is understood, of course, that such an expression has no political significance whatever, as the members present doubtless entertain different views upon the political questions of the day; but it is simply a matter of courtesy. I appoint Capt. White and Major Dresser, or, rather, Major Dresser and Capt. White, preserving the military order as much as possible.

CAPT. WHITE—As the Committee on Applications for New Memberships is not yet ready to report, and before they do so, I desire to call the attention of the Association to the case of Mr. Thomas Curley. He was formerly a member of the Association, and his initiation fee was paid. He was present at many of our meetings, and took part in the proceedings, and was for some time an active member. In the readjustment of our Constitution, in respect to the mode of representation, he was left out. I think it is simply a matter of courtesy toward Mr. Curley that he should now be reinstated as a member without paying an additional initiation fee, and that his name should again be placed upon our list of members. At the time of the readjustment of our Constitution, in respect to the method of representation, the name of the president of the company was substituted. Mr. Curley, however, has once paid his initiation fee, and I therefore move you, sir, that he be reinstated as a member, and his name placed upon our roll without

his paying an additional initiation fee. He called my attention to the matter, and simply desired me to make this statement to the Association, in order that they might determine what his status should be. He is perfectly willing to pay the initiation fee should the Association so declare. But it seems to me, Mr. President, in view of the position that Mr. Curley has heretofore occupied toward this Association—having once paid his initiation fee, that it would not be courteous or just toward him to insist upon its being paid again before he is made a member.

MR. DENNISTON—Does not Mr. Curley's name stand upon our list of members?

CAPT. WHITE—It does not; he is not on the list of membership at all. The president represents the company. He was substituted for Mr. Curley at the time of the readjustment.

MR. NETTLETON—Perhaps there are many members of the Association who do not know exactly how that came about. In the original organization of the Association the membership was made up of companies. Each company was entitled to three delegates to sit in the Association. When the new Constitution was formed the membership was changed to individuals, and then the Secretary applied to each company for the name of a person who should be a member in the place of the company, without paying any new initiation fee. The president of the company was the name furnished to the Secretary, instead of Mr. Curley. Mr. Curley had attended the meetings of the Association before as a delegate, but when I sent out the letter requesting the name of a person to represent the company which he had formerly represented, the name of the president was given, and therefore Mr. Curley's name was withdrawn. There are several other instances of the same kind. It seems to me, Mr. President, that it would not be right or just toward others who have occupied a position similar to that of Mr. Curley, if you should now reinstate him without the payment of an additional initiation fee. Other gentlemen who have been situated similar to Mr. Curley have again paid their initiation fee, and have become members. I do not see, therefore, why an exception should be made in favor of Mr. Curley

Of course, if there are any special reasons why he should not pay his initiation fee, I shall make no objection; but I simply make these suggestions in order that the members of the Association may know precisely what they are doing.

MR. HARBISON—I would like to inquire by whom the initiation fee was originally paid. Of course, if it was paid by Mr. Curley, he ought not to be required to pay it again. If it was paid by the company, however, and the company is now represented by its president, I do not see any reason why Mr. Curley should not pay his initiation fee in the regular way if he desires to become a member.

MR. NETTLETON—The original initiation fee was paid in the name of the company, in the usual manner. I do not know who paid it.

MR. HARBISON—Then, if I understand the matter correctly, the president represents the company upon our roll.

MR. NETTLETON—He does, and he is in the habit of attending the meetings.

THE PRESIDENT—It is for the Association to decide whether Mr. Curley will be admitted as a member without the payment of the initiation fee, and it is for them to say whether they will establish such a precedent as such action upon their part would necessarily establish.

MR. CARTWRIGHT—I would inquire, Mr. President, whether we can, by resolution, change the Constitution.

THE PRESIDENT—No, sir; it cannot be changed by resolution.

MR. CARTWRIGHT—I believe the provision of the Constitution is, that each person shall pay so much initiation fee before he becomes a member.

CAPT. WHITE—I do not wish to press the matter at all if it is not perfectly agreeable to every member of the Association. I consider Mr. Curley a member of this Association by the right of pre-emption, so to speak, he having originally paid the fee. It is not by any means a personal matter. Mr. Curley simply spoke to me about it. He is perfectly willing to pay the initiation fee. It is not a matter of charity with him. He wished to know what his rights were, and how he stood in regard to the matter.

Mr. Harbison—I understand from the Secretary that Mr. Curley did not pay the initiation fee himself, but that it was paid in the nâme of the company and by the company, and that the company is now represented by its president. That being so, Mr. Curley has not paid his initiation fee.

Mr. Nettleton—Being Treasurer of the Association, and having at heart the financial interests of the Association, I, for one, want as much money as we can get; and if there are no special reasons why Mr. Curley should be admitted without the payment of the initiation fee, I think he ought to pay it.

The President—The members of the Association have heard the motion of Mr. White, and it is for them to say whether they will suspend the rules in the case of Mr. Curley.

The motion was then put and lost.

The President—Mr. Curley will understand, of course, that the action of the Association upon this matter does not imply the slightest disrespect to him personally; but it is taken for the purpose of upholding and preserving the integrity of the rules as adopted.

Major Dresser—If it is in order, Mr. President, I would make a motion to the effect that Mr. Curley be invited by the Association to attend this meeting and take part in the proceedings. He can put in an application for membership afterward, and such application can be acted upon at the proper time.

Carried.

Capt. White—Mr. Curley has already made an application, and it will doubtless be acted upon as soon as convenient.

The President—Mr. Curley, of course, will consider himself invited to participate in the proceedings of the Association, pending action upon his application, and not only invited, but pressed into the service.

REPORT OF COMMITTEE ON APPLICATIONS FOR NEW MEMBERSHIPS.

Mr. Neal—The committee are ready to report upon applications for new memberships. The Executive Committee have

received the following applications, which they herewith present to the Association for its action :

B. F. Archer, . . .	Camden, N. J.
P. T. Burtis, . .	Chicago, Ill.
Henry Budd, . . .	Philadelphia, Pa.
J. H. Baumgardener, .	Lancaster, Pa.
Thomas Curley, . .	Wilmington, Del.
B. W. Cochrane, . .	Gloucester, Mass.
W. H. Frost,. . . .	Plymouth, Mass.
W. P. Fodell, . .	Philadephia, Pa.
John Fowler, . . .	Philadelphia, Pa.
J. J. Griffen, . .	Philadelphia, Pa,
E. C. Jones, . . .	S. Boston, Mass.
J. H. Knowles, . .	Richmond, Va.
G. W. Kraft, . . .	Philadelphia, Pa.
H. G. Morris, . .	Philadelphia, Pa.
Wm. McDonald, . .	Albany, N. Y.
C. H. Merritt, . .	Danbury, Conn.
P. S. Merrifield, . .	Troy, N. Y.
A. M. Norton, . .	Nashua, N. H.
J. C. Pratt, . . .	Jamaica Plains, Mass.
G. G. Ramsdell, . .	Vincennes, Ind. .
A. W. Richardson, . .	North Adams, Mass.
Jacob Roxbury, . .	Alexandria, Va.
S. G. Stiness, . . .	Pawtucket, R. I.
R. B. Swain, . .	Cape May, N. J.

The applicants who have not yet paid their initiation fee will please step forward and do so.

THE PRESIDENT—Does the Constitution require payment previous to election?

MR. NEAL—I think not ; but it is well to strike while the iron is hot.

THE PRESIDENT—Perhaps that part of the business had better be done after action is taken on their application.

On motion of Mr. Cartwright, the Secretary was authorized to cast the ballot on behalf of the Association for the election of the gentlemen whose names were read.

Mr Neal was appointed teller.

There being no objection, the Secretary cast the ballot and the teller declared that the gentlemen named were unanimously elected members of the Association.

The President then said:—Gentlemen, on behalf of the Association, I welcome you as members. You will please step forward and be introduced to the Association and sign the Constitution.

The new members then came forward and were duly introduced to the Association and signed the Constitution.

THE PRESIDENT'S ADDRESS.

The President then addressed the Association as follows:

Gentlemen of the American Gas Light Association—When you convened, one year ago, in annual session, a dark pall lay upon the business interests of the American people. In September, 1873, a great change came. Manufacturing, building, trading, speculating, all culminated, and the immutable laws of trade asserted themselves in a destructive reaction. Widespread financial disaster followed, and continued for several years. Every department of industry was subjected to its paralyzing influence. None had grown more rapidly during the preceding period of personal and municipal extravagance than that which you represent, and few suffered more during the years of enforced economy.

To-day we have met under brighter auspices. The pall has been lifted; the wheels of industry are moving; trade is distributing with busy hands the products of farm and factory; confidence has returned; in the slang phrase of the politician, business is "booming." Aside from any personal and professional considerations, it is a matter of joyous congratulation that there is employment for every hand, for every muscle, for every brain; that labor and capital may go forward hand in hand, each employed and each well paid. Gentlemen, our seventh annual meeting is held under the most agreeable circumstances. But we have not met for rejoicing and merry-making, but to realize the practical purposes of our organization. We have

come together to compare experiences, to compare practices, to compare results—hoping that we may gather from the mass of our experiences and practices that which will be most useful, and therefore most valuable.

At the outset, it seems eminently proper to inquire what is the present condition of the gas interest in this conntry. That it is a large interest I need not say. It ramifies every section of our widely extended domain, and employs in its operations hundreds of millions of capital, and many thousands of men. For several years this interest has been subjected to a severe ordeal.

The ordeal to which I have alluded is the competition which has arisen from the discovery of petroleum in large quantities, the progress made in the art of refining it, and the invention of lamps adapted to its use. These facts, together with another, to wit, the very low price to which this natural illuminant has declined, have operated powerfully against the gas interest in many cities, and perhaps to some extent in all places where illuminating gas is made and sold. In some the use of gas has fallen off, it is said, as much as one-third ; but this is exceptional. I have no doubt the interference of oil with gas has been much assisted by the hard times experienced within the past few years I fear it must also be said that in some instances a high rate charged for gas, illiberality in the extension of mains, and an unhappy manner of dealing with customers—sometimes one, sometimes the other—and sometimes all these causes have combined to alienate business and depress the gas interest. So far as I have observed, those who have been burning gas do not willingly relinquish its use and take petroleum, but they are impelled by some strong influence when they make that change ; and I have also noticed that when that influence has been removed the use of gas is gladly resumed.

That petroleum, in some of its forms, is, in one view, cheaper than gas, even where gas is sold at a low price, is no doubt true. A family may manage to light its dwelling, for ordinary purposes, by the use of petroleum at a low cost ; but the light is not as convenient, not as safe, and not as pleasant

as gas light. A place of business may be lighted by petroleum at a less cost, perhaps, than by gas; but every one knows that the saving in cost is at the expense of convenience and cheerfulness. Necessity knows no law—and many have discontinued the use of gas because, during the hard times, they could not pay for it.

That petroleum light is really, volume for volume, cheaper than gas when sold at a moderate price, may well be doubted. I do not believe it is. The truth is, no article of domestic consumption is so injudiciously used as gas. Men allow the decorator to cover their walls with fashionable paper, which bears upon its face colors so dark that nearly every ray of the best light is absorbed, and then complain that the gas is poor. I have seen rooms thus decorated that the sun in all its glory could hardly light. The modern church chandelier, with its multitude of small burners, is another specimen of the way how not to do it. Gas enough is burned in a church so supplied to light it beautifully, but it is so subdivided that the combustion is very imperfect, and the house is gloomy; whereas, if the same, perhaps less, gas were burned in suitable fixtures, the illumination would be splendid. Many a room would be better lighted with one large burner than it is with four, and at much less cost. These statements are intended to illustrate one of the difficulties the gas manager has to contend with. If the consumer could be taught to use gas judiciously, a large part of the trouble with petroleum would disappear.

Here is a field where "reform is necessary." Can this Association do anything to bring about such a reform? I fear the work will be slow, but I think a good deal may be done, and hope some attention may be given to this matter during the sessions before us.

Since we last assembled in annual convention, the agitation for cheaper gas has gone on, and, in some cases, has become intense. In many cities the municipal authorities, desirous of reducing taxation, have been most importunate in demanding a reduction in the cost of public lighting; and when gas companies have declined to yield to this demand, lighting with gasoline has sometimes been substituted for that by gas. Here,

then, is another point of collision between the gas interest and its antagonist, petroleum.

Gentlemen, I am forced to believe that the question of the hour with gas managers is this:—"How can we reduce the cost of gas?" By cost, I mean the cost to the manufacturer; and in the cost I include material, labor, repairs, general expenses, use of capital, depreciation and risk. The people demand good light at lower rates; and the practical question with every gas manager is:—"What can I do in the way of economy; in the way of increased production; in the way of diminished expenses, that shall enable my company to meet this demand, and, at the same time, secure to my stockholders fair remuneration?"

To the practical solution of all that is involved in the foregoing, every earnest gas manager will give heed; and, with your indulgence, I will offer a few leading suggestions indicating my own view of the way to do it.

In my judgment, the very first step to be taken by any gas manager who wishes to be in a position to sell his product at a moderate figure, is to put and keep his works in the best possible productive condition.

This by no means implies the acquisition and the application of every patented contrivance which enthusiastic inventors and greedy vendors may urge upon his attention. The prudent manager will be slow to expend the money of his stockholders upon new-fangled schemes, however specious, or however highly recommended. He will undoubtedly be glad to accept and use any new system, or any new device, which, after thorough trial, has been proved to be really valuable.

The best possible productive condition does imply such retorts, as regards size, shape and weight, as experience has proved to be at once most durable and most effective. It implies such settings as the same teacher has shown to be best adapted to the maintenance of the integrity of the bench and the most economical application of fuel. This condition also includes such condensing scrubbing and purifying appliances as the same test has demonstrated to be both efficient and economical.

The great point to be first attained is to put your gas into the holder at the lowest possible cost. To do this there must be thorough economy of material. You must obtain from your coal the largest possible yield of gas, in the use of the smallest quantity in fuel and labor.

I do not undertake to say how many cubic feet of gas should be obtained from a pound of coal, nor exactly what quantity of fuel should be used, nor how much labor should be applied. I think there are gentlemen here who possess valuable information on these points, and I also think this Association ought to have the benefit of this information. It may be well known to all that great progress has been made in reducing the amount of fuel required for carbonizing. I was emphatically told by the engineer of a works in Paris which I visited in June last, that the quantity of coke required for carbonizing the coal used there, did not exceed fifteen per cent of the amount made in his works; and I presume the statement was correct. I may also say that the amount of labor required for firing was, in the same establishment, reduced to a minimum.

It is not my purpose to advertise any of the several plans which are in use for reducing the quantity of fuel requisite, and the labor necessary for its application. Nor do I feel qualified to decide which is best. My impression is strong that, while each has its merits, there may be selected one which gas managers will find of great use in reducing the cost of their gas.

You are well aware that much talent and labor have been expended in producing machines for the saving of labor in drawing coke and in charging retorts—two points where it is desirable to reduce the cost and diminish the severity of the work. I think, until recently, but little success has resulted from this expenditure of labor and talent. I know that I am treading on delicate ground, but I trust I shall be pardoned for calling your attention to the inventions of a gentleman of Cincinnati, which I have but lately seen in operation, and in reference to which, conservative as I am, I cannot but cry "Eureka!" I made a trip to Cincinnati on purpose to see

Mr. Ross's drawer and charger in service at the works of the Cincinnati Gas Light Company. Both machines seemed to me to do their work perfectly. They are not expensive, not intricate, not easily damaged or broken, and I was assured by the superintendent of the works, who has had them some time under his eye, that the two, operated by three men—not skillful engineers, but such as may be had for $1.50 per day—will draw the coke from and charge twenty-five benches, of six retorts each, every four hours. The maximum may be thirty; the minimum cannot be less than twenty. This does not include taking away and caring for coke, nor does it include firing of benches. Each practical manager can compute for himself the saving which would be made in his works, were they so adjusted that fifteen per cent., or even twenty-five per cent. of the coke made would do the carbonizing, that one man could fire for twenty benches, that three men with two machines could draw the coke from and charge twenty-five benches, and that two additional men would quench and take care of the coke from the same twenty-five benches.

I venture the prediction that the day is near when these things will come to pass. Of course, I only speak in reference to large works. I may also say that the realization of this anticipation implies, in most cases, a good deal of change in the arrangement and structure of retort houses.

Should what I have predicted be realized, each manager can estimate approximately how much the total cost of each thousand cubic feet of gas will be reduced. I ought to add, that I do not ask any one to take my opinion in regard to the matters just discussed, but I hope that each and all interested will give the subject personal examination.

The second step necessary to the end I have mentioned is to see that your distributing mains and all your service pipes are as near tight as human skill and care can make them. Do not allow the illuminating product of your works to waste through leaky pipes into the ground. It will make a large difference in results if you lose only five per cent of your make of gas instead of fifteen to twenty-five.

The next step, after having put the works and distributing

department in "tip-top" order, is to purchase only the best material. Gas Companies are considered good customers, because they use largely and pay promptly—hence they are beset by coal dealers to buy. Now, there is a great deal of poor coal offered to gas managers, and urged upon them by ingenious importunity. I have known the offer to be accompanied by tempting appeals to the cupidity of the purchasing agent. I trust every such agent is proof against such appeals, and that, if he does not kick the tempter out of his office, he does at least say emphatically, "Get thee behind me, Satan!" However this may be, in one way or another, by some means a large amount of poor coal is annually carbonized. This mistake is serious, for thereby comes meager production of gas, poor coke, large expenditure of fuel, labor, retorts, and other apparatus. I had almost said that a fair profit may be wasted in the use of poor coal. I will say that mismanagement at the works may mar the success of a company otherwise well managed.

The fourth point is the application of labor. Employ just enough, neither too little nor too much. Have a place for every man, and keep every man in his place. Make everybody count. Have no deadheads, no sluggards.

The fifth step is close and thorough accountability. Sometimes a man wins the confidence of his employers, and sadly abuses it. I know a case in point. A man of honest appearance held the position of coke-yard master. He superintended the delivery of coke upon orders issued at the office. After years of service he was discharged, because it was discovered that he was largely over-delivering. He had been doing so for a long time, so that thousands of dollars had been lost to the company employing him. His detection came at last through the careful manner in which the superintendent kept his carbonizing book.

The care and management of residuals is, as you all know, a most important element in the matter we are considering. Our English friends have largely the advantage of us in the value of everything in the way of residual products.

Cannot the gas manager in our country do something more effective than heretofore in this department? The subject is worthy of our careful study.

There is another method by which the cost of gas may be indirectly reduced. I refer to the extension of its use in cooking, heating, and running engines.

The apparatus for manufacturing and distributing gas being given, an increase in the product may be made at small cost, except for material and labor. In other words, as the quantity is increased, the cost of the whole is relatively diminished. And it is especially desirable to increase the demand for that gas which will give employment to our works, including mains, by day and in summer. If the gas engine were generally in use for light manufacturing, as it might be, the demand would be mainly by daylight, and would continue in summer. Now our mains earn little by day, and in the warm season.

Something has been done, but only a little. I am sure there is a wide field for gas companies in the department just mentioned, and it should be occupied.

Thus, gentlemen, I have suggested, in a hurried manner, a few of the points where I think improvement may be made. I have said nothing in regard to the conduct of the gas business at the head office. It is not needful to say that the same economy, the same careful management, should prevail in the conduct of the office where bills are made and collected, as at the works. Every needlessly irritating rule should be either abolished or modified, and in dealing with consumers, kindness, patience and politeness should invariably rule.

In what I have said I have not aimed to be original, but only to be practical.

I have entire faith in the permanence of our business, and I believe there is a brilliant future, in more than one sense for illuminating gas; but I also believe that, to be eminently successful, we must meet the demands of the hour, and meet them manfully and liberally.

THE PRESIDENT—The next business in order is the Report of the Executive Committee on amendments to the Constitution proposed last year. The amendments proposed at the meeting last year are before you in the printed proceedings which are distributed to the members to-day. The only other reports would be the report of the Finance Committee and of

the Treasurer. Mr. Denniston, however, I believe, on behalf of the Executive Committee, has something to propose; and it is in order now to do so. It is in regard to changes of the Constitution, and some others. It is now in order to receive the report of the Executive Committee.

REPORT OF THE EXECUTIVE COMMITTEE.

MR. DENNISTON—Mr. President: It has been customary for the Executive Committee to make recommendations at the commencement of the meeting of the Association, not only in regard to amendments proposed the previous year, but in regard to amendments to be acted upon at future meetings. Heretofore the papers to be read have been submitted to the Executive Committee to be approved before reading. At this meeting of the Committee there was but one paper submitted. At some previous meeting (I do not know that I was present) a resolution was adopted by which the reading of papers was to be allowed, if notice had been given to the Secretary. There was, therefore, no necessity for the approval of the papers by the Executive Committee, the passage of this resolution having relieved the Committee from that duty. At the meeting of the Committee, held last evening in the parlor of the Girard House, the Secretary reported the names of those who had been stricken from the roll of membership. Mr. E. S. Funnell was reinstated, upon the payment of back-dues. Mr. J. D. Patton's letter was read; and, on motion of the Secretary, he was instructed to bring it before the meeting. Those who attended the last two meetings of the Association will remember that the Association first refused to have Mr. Patton's article read. At the last meeting it was read and laid aside without any discussion, because there was not time to discuss the merits of the paper. The discussion of it, and the printing of it, were deferred until Mr. Patton was present. Now, the Committee recommend that the Secretary bring the letter of Mr. Patton before the Association, and the Association can then say what they will do.

The Committee also recommend that Article XXX of the Constitution be amended. It now reads:

"Any member may retire from membership, by giving written notice to the Secretary, and the payment of all annual dues to that date; but he shall remain a member, and liable to the payment of annual dues, until such payments are made."

The amendment proposed is after the words, "to that date." We recommend that, instead of the words, "but he shall remain a member, and liable to the payment of annual dues, till such payments are made," the following be inserted: "unless released from said payment by the vote of the Executive Committee. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll by the vote of the Executive Committee." The amendments which were proposed the members will find in the little printed book, upon page 11. The amendment to Article XXX, that the Executive Committee now recommend, is one to be acted upon at the next meeting of the Association; and it is, as I have stated, namely, that all the words after the words, "to that date," be stricken out, and that the words that I have read be substituted in their place.

The Committee also recommend that Article XXV be amended, by striking out all after the words, "before being read." The Article now reads:

"All papers read at the meetings of the Association must relate to matters either directly or indirectly connected with the objects of the Association, and must be approved by the Executive Committee before being read, unless notice of the same shall have been previously given to the members, by the Secretary."

The amendment proposed by the Committee is to strike out all after the words, "before being read;" the rest of the Article to remain as it is now.

The Committee also recommend that Article XII be amended, by striking out the words, "after the close of the meeting at which they are elected," so that the Article will read:

"The officers of the Association shall assume office immediately after their election."

The object of this amendment is to have the officers who are elected take their seats immediately after their election, and not the year following, as at present.

I also desire to state, on behalf of the Committee, that Mr. Sherman's paper was read and approved.

The Committee also recommend that the Association meet at 10 o'clock: at 1:30 take a recess until 3; and then sit from 3 until 6 in the evening. On Thursday—meet at 10 o'clock in the morning; at 1:30 take a recess, and meet again at 3, and remain in session until the adjournment *sine die*. The Committee of Arrangements have made out a programme of the way in which it is proposed that Friday and Friday evenings shall be spent; and when the members receive their little *billet doux* they will know what they mean. I move, Mr. President, that the report of the Committee be received, and that the recommendations be acted upon separately.

Carried.

MR. NEAL—I move, Mr. President, that the first recommendation of the committee be adopted.

THE PRESIDENT—Mr. Denniston will please state the amendments in their order.

MR. DENNISTON—The first amendment proposed by the Committee is the amendment to Article XXX, which I have referred to already, namely, to strike out all after the words "to that date," and to substitute in lieu thereof the words "unless released from said payment by vote of the Executive Committee. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll thereafter, by vote of the Executive Committee."

MR. CARTWRIGHT—I submit the question, Mr. President, of whether we had better pursue the regular order of business, and let this matter come up as general business. It will undoubtly lead to discussion, and I think will more properly come under the head of general business.

MR. DENNISTON—There are some things in the report of the Executive Committee which I think ought to be acted upon at once—for instance, the recommendation in regard to the salary of Secretary. That, I think, should be disposed of before the Secretary is elected, so that if there are different candidates for the position of Secretary they may know before-

hand what the salary is to be. These recommendations of the Executive Committee have generally been attended to first. There is another recommendation which was made at the last meeting, in reference to the change of officers—that is, that there should be a certain change, so as to secure rotation.

If that proposed change is adopted by the Association, I think action should be taken upon it before we go on with our general business, so that if there is a committee appointed to recommend officers for this Association they will do so under the new regulations.

THE PRESIDENT—Before proceeding further I will state to the Association that I have consulted with the Secretary, and he thought, and I think, we had better dispose of this miscellaneous business at once. I do not understand it to be a violation of our order of business. I think it comes naturally in connection with the report of the Executive Committee, and it has always been our custom to dispose of the report of that Committee at once. There is great force in the suggestion that has been made—that certain amendments which were proposed at the last meeting, which will come up for action at this meeting, should be acted upon at once. If the objection is not insisted upon, I think we had better proceed without further delay.

MR. CARTWRIGHT—I do not insist upon my motion; I simply suggested it; but if it is the desire of the Association to proceed with this business now, I certainly have no objection.

MR. NEAL—It seems to me, Mr. President, that there is an absurdity in rule XXX as it now stands. It says, "but he shall remain a member and be liable to the payment of annual dues till such payments are made." That is to say, he always remains a member if he does not pay. I think such a palpable absurdity as that ought to be corrected at once.

THE PRESIDENT—Mr. Denniston will please read the rule as it will stand when amended.

MR. DENNISTON—Article XXX will read, if it is amended as proposed, as follows:

"Any member may retire from membership by giving writ-

ten notice to that effect to the Secretary, and the payment of all annual dues to that date unless released from said payment by a vote of the Executive Committee. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by vote of the Executive Committee."

The recommendation was then adopted.

MR. NEAL—I move that the next recommendation of the Committee be adopted.

THE PRESIDENT—Mr. Denniston will please read the next amendment.

MR. DENNISTON—The next amendment proposed is an amendment to Article XXV which is to strike out all after the words "before being read." The Committee recommend that this article be amended by striking out the words "unless notice of the same shall have been previously given to the members by the Secretary.

This recommendation was then adopted.

MR. NEAL—I move that the next recommendation of the Committee be adopted.

THE PRESIDENT—Mr. Denniston will please read the next recommendation.

MR. DENNISTON—The next recommendation is to amend Article XII by striking out the words "the close of the meeting at which they are elected," so that the article will read: "The officers of the Association shall assume office immediately after election."

We recommend to strike out the words, "the close of the meeting at which they are elected," and to insert the words, "after their election," the balance of the section to stand as it now is.

MR. NEAL—This amendment was prepared unanimously by the Executive Committee. Since the amendment was acted upon by the Executive Committee, I understand that some of the members of the Association object strongly to any change being made in that article of the Constitution. For my own

part, it seems to me highly proper that when the President or any officer is elected, he should take his place, and not wait a whole year. If our meetings were held weekly or monthly the case would be different, but as we meet but once a year, it seems to me that our officers should assume their duties as soon as they are elected, precisely as they do in other organizations. As the rule now stands, if some one were elected in the place of Gen. Roome to-day, Gen. Roome would preside at this meeting, and his successor would not assume his position until the year following, unless there was a meeting held in the meantime. In the meetings of all associations or organizations which I have attended it has been customary for the officers to assume their places as soon as they were elected. That is the case with the New England Association, and there has been no objection to that course. As soon as the President is elected he takes his seat, just as he does in the case of political conventions. I am told by the gentleman who sits before me (Major Dresser) that the British Association of Gas Managers follow the same custom that we do. For my own part, I am in favor of the change as proposed; but there are some gentlemen here would like to be heard in opposition to the proposed amendment.

MAJOR DRESSER—Mr. President: It seems to me that the proposed change of the XII Article will work to the detriment of the Association. As Mr. Neal has stated, the New England Association do install their officers immediately after their election. That, perhaps, would do very well in case of a local organization like the New England Association; but, for a National organization like ours, I do not think it would be found to work so well. This Association is not like political conventions or business organizations. I think very few gentlemen present know how much labor is required on the part of the Secretary to get ready for one of these meetings. A vast amount of work has to be done by him in the way of corresponding with members, and providing for papers being prepared and presented, and various other matters of detail which it would take too long to enumerate. It requires, for a proper performance of this duty, a thorough familiarity with the duties

of the office; and it seems to me, therefore, that the present system is by far the best. Now, the Secretary who is elected, for instance, at this meeting, holds over until the next, as does the President. The result is that both the President and Secretary take particular care in having the meetings over which they are to preside the most successful of any that have previously been held; whereas, if a new President and a new Secretary come in at once and assume the duties of their office immediately after election, they are in no wise responsible for the success of the meeting.

There was a rather curious circumstance that occurred in connection with the British Association of Gas Managers, which, I think, will illustrate how the change will work. The British Association adjourned to meet in Paris. When they got there the President-elect of the Association was not President of the Association, by virtue of the fact that the Association adjourned to meet in Paris, because the Society had not adjourned *sine die*. It had merely adjourned to Paris, and the officers who had been in office the previous year had been over to Paris and had made all the arrangements together with the French Society; they had done all the correspondence, and they were the men who were known in Paris. I think, Mr. President, that very much the same condition of things will exist if we decline to adopt the change proposed by the Executive Committee. The old officers have done the work, they have made all the arrangements, they have done everything in their power to contribute to the success of the meeting, and they have the credit of it. I really think it is for the best interests of the Association to keep the matter just as it is.

Mr. Helme—It seems to me there is a great deal of force in what Major Dresser has said; and as this matter has no doubt been very thoroughly considered by the Executive Committee, I, for one, would like to have Mr. Denniston state what the reasons are which have prompted the Executive Committee to recommend this alteration.

Mr. Nettleton—I would state to the Association that I had something to do with the original draft of the Constitution, and this article was put in its present form for the purpose of

enabling the President to prepare an address that would be a credit to him and to the Association, and at the same time be a practical benefit; and to the rule, as we now have it, I am free to say I think we are indebted for the excellent address by our President to which we have listened this morning.

MR. HARBISON—According to our By-Laws, the address of the President comes before the election of officers, so that the gentleman who is elected President this year will deliver his address next year, whether he is elected next year or not. His duty being to deliver an address, he will deliver it as provided for by the article under consideration. We have had this morning the pleasure of listening to the address of the President, and it has been delivered as it has always been the custom to deliver it, before the election of officers. So that the difficulty, as suggested by Mr. Nettleton, is entirely removed. The article now provides for a carefully prepared address from the President—one which shall be a credit to him when delivered, and a credit to the Association. I think it is very desirable that the officers elected should be installed immediately after their election; and, for one, I am in favor of the change. I do not believe that this Association is going to adjourn to meet in Paris, or London, or Scotland, or any other place abroad.

MAJOR DRESSER—I hope you will, some day.

MR. HARBISON—I hope so, too; but that time has not yet come, and so far as we can now see, is yet a long way off. When there is a reasonable prospect of meeting abroad, it will then be time to consider such a prospective difficulty. But the danger seems to be so remote that it is not at all worth considering,

I believe it is the duty of the Secretary of the Association to have his arrangements completed, so far as they can be, before the opening of the meeting; the order of business so arranged and laid out, and the arrangements so far completed, that if a new man is elected to the office he can go right along and carry on the business just as well as the Secretary could. I do not believe that any gentleman of this Association who might be chosen to the position of Secretary to-day would find any dif-

ficulty whatever in entering upon the discharge of his duties at once, because all the arrangements for this meeting should have been made previous to our coming together. I have not the slightest idea that any practical difficulty of that kind would arise from the proposed change.

Another suggestion which has occurred to my mind is that, were the rule as it at present stands, if we elected a President at this meeting to serve for the ensuing year, and he does not take his place until the next meeting, a case might arise when we would not have the pleasure of having him as our presiding officer at all. Life is very uncertain. The position of President of this Association is an honorable one, and I think it is so considered by the gentleman who has held it since the organization of the Association. I think that the rule ought to be so amended that the gentleman whom we chose to the position of President should preside over the deliberations of the Association at the time when he is elected, so that we may be guaranteed that we will have him as our presiding officer at least one session. I hope, therefore, that the amendment will prevail, and that hereafter the gentleman whom we select to fill the position of President may be at once in the office and preside over our deliberations.

MR. STARR—If I understand correctly in relation to the election of officers, it is that those elected this year do not take their places until next year. It seems to me that if the President is to have the credit for a good meeting, and one that is a credit to the Association, he should come into office so as to be recognized as soon as he is elected, otherwise, if a President knows he is going out, and that his term of office expires at the end of the year, just before the Association meets, he knows that the meeting does not belong to him, and therefore he does not feel responsible for its success. But if he takes his place immediately after his election, he then becomes identified with the Association, enters upon the discharge of his duties at once, and interests himself for the success of the meeting which will be held under his presidency next year. He will be interested in having it said at the end of his term of office that the meeting with which it closes is the most

successful one that has been held, and that he will work to the end, so that it will be a credit to him and to his administration. It seems to me, therefore, that the proper way is for the President and the other officers to take their places immediately after their election ; or they may be elected to-day and take their positions to-morrow, if it is found more convenient and better calculated to promote the transaction of business. I am, therefore, in favor of the amendment, and hope it will prevail.

MR. DENNISTON—In answer to the remarks of Mr. Helme, as to the reasons which governed the Committee in making this recommendation, I will state that they were some such as have been presented by Mr. Harbison. I should like to inquire, Mr. President, what is the necessity of having an Executive Committee. If every little thing of this kind is to be discussed in open session, we will not get to our papers for a long time, and will then be curtailed in our discussion. This matter was fully discussed in the Committee, and the arguments were presented pro and con, as they have been here ; and it was passed upon by the Committee unanimously, supposing it would be at once adopted by the Association. As Mr. Harbison has stated, the election of officers does not come until after the report of the Treasurer and Finance Committee. The business then of the old Secretary and Treasurer is closed, and the new Secretary and Treasurer enter at once upon their duties. I do not see how any difficulty of the kind suggested by Major Dresser can possibly arise, for the reason, as just stated, that the duties of the old Treasurer are completed when his report is presented and approved by the Finance Committee. As Mr. Harbison has suggested, the arrangements for the meeting have all been completed by the old Secretary, and the new Secretary has therefore nothing whatever to do except to perform the duties which devolve upon him at the session at which he is elected. Like his predecessor, he will perfect all the arrangements for the next meeting during the coming year, and so his successor in turn will be prepared to enter upon the discharge of his duties. In the case of the President, he has a whole year in which to prepare his address, for,

as I have already stated, the address of the President precedes the election of officers. During this period of a year, if he has discovered anything new, if he has had any experience that will be of practical benefit to the Association, he will be able to present the results of his discovery and experience in the address which he will deliver next year. I do not see how the difficulty suggested by Mr. Nettleton, in reference to the address of the President, can possibly arise. But I beg leave to say that the reasons which influenced the Executive Committee to make this recommendation have been substantially stated by Mr. Harbison, and they seem to me to be conclusive. As he said, in the case of the Secretary everything is turned over clean and clear, and settled up and audited at the time of the election of his successor.

Mr. Burtiss (Chicago)—For my own part, I am entirely opposed to any change in the Constitution. If the change proposed is adopted, we will have this state of things: we will have a President who will serve during half a session, and he will really be but half of a President. You, sir, presided during a part of the session this morning. Now, if the change proposed is made, and the gentleman who is elected President takes his seat immediately upon his election, you will have presided until such election, and he will then preside during the balance of the meeting of the Association. Now, I am not in favor of any such thing as that. When you are the presiding officer, it should be your privilege and your pleasure to preside over our deliberations for one session at least; but if the change proposed is made, you preside over a portion of the meeting of the Association, and some other gentleman who may be elected presides over another portion. If you are to have the credit of presiding at all, it seems to me that you should have the privilege of presiding during an entire session, and not have the presiding officers changed in the middle of a session. If the amendment as proposed is adopted, we change captains in mid-ocean. The man who is elected President ought, by all means, to preside over the deliberations of an entire session at least. Something like the results which would follow a change of captains on board of a steamer

in mid-ocean would be likely to follow a change of presiding officers in the middle of a session of the Association, and I trust that the amendment will not prevail.

Mr. NETTLETON—I would like to say a word upon this matter so far as the Secretary and Treasurer are concerned. One article of our Constitution provides for the payment of annual dues in advance, and at the commencement of the meeting. The Association last year fixed the end of the fiscal year at the 30th day of September. That closes the fiscal year. Now, if members will think for a moment they will remember that the payment of annual dues comes at the annual meeting next following the commencement of the fiscal year. Two hundred receipts have to be made out. Certainly, they must be made out by the Treasurer who is in office. They have all got to be arranged ready for payment, and gentlemen will pay to the Treasurer in office at the commencement of the meeting; so that the practical working of the change will be that it will leave the matter of the annual dues unsettled and undisposed of up to the very time when the new Treasurer is elected. This comes in the old Treasurer's account to be settled up. The Treasurer cannot stop the meeting to make up his account. He is obliged to furnish vouchers to every member who pays his annual dues; and if these vouchers are lost he must charge himself with the money that has been paid. Now, if these things are to be handed over to the new Treasurer, during the meeting at which he is elected, it will cause a great deal of confusion and will take up a good deal of time. That is one of the reasons why the article was made as it was originally, so that everything would work harmoniously and keep the Treasurer's account in his hands, and under the control of the present Treasurer, until it was completely settled up and adjusted; and then, when adjusted and settled up, the papers and accounts could be handed over to his successor in office. By this system everything works harmoniously and the new Treasurer enters upon the discharge of his duties free and clear, with all previous accounts adjusted, audited, and closed. Any other system would result in delay and confusion; the succeeding Treasurer would have a great deal of

trouble, and the Association would be very much incommoded.

Mr. Harbison—One word, Mr. President, in answer to the objection presented by Mr. Nettleton. I cannot see any practical difficulty whatever in the change so far as the accounts of the Secretary and Treasurer are concerned. A change has to be made sometime; that is clear. There is no article of the Constitution which says that a member must pay before the opening of the meeting. The article says that he must pay in advance. The practical working of the thing is, Mr. President, that the members do not pay in advance. The Treasurer takes the money at any time, and gives a receipt for it. When the meeting is closed the receipts and the money are handed over to the new Treasurer. There is no difficulty whatever about the matter. Of course, the new Treasurer will not want to use the receipts of the old Treasurer; the new Treasurer will be able to go on with his work, and the performance of his duties, without any trouble at all. The old Treasurer will have an opportunity of closing up his accounts at any time, and turning them over to his successor. It is simply a matter of arrangement between the two gentlemen. I cannot, for my own part, see any difficulty in the way of this change at all.

The President—The question now is upon the adoption of the recommendation of the Executive Committee in regard to the amendment of the XII Article as proposed.

The recommendation was not adopted.

Mr. Neal—I move that the next recommendation be adopted.

The President—Mr. Denniston will please state what the next recommendation is.

Mr. Denniston—The next recommendation of the Committee is that the Secretary be instructed to furnish two copies of the published proceedings to each member. There is also a recommendation in regard to the salary of the Secretary. This question was discussed last year, and has been discussed annually heretofore. The question came regularly before the Executive Committee, was duly discussed and considered, and presented to the Association in the form proposed.

THE PRESIDENT—The question now is upon the adoption of the recommendation of the Committee in regard to furnishing copies of the published proceedings to each member, namely, that two copies of the published proceedings be supplied to each member of the Association who is in regular standing.

The recommendation was adopted.

MR. NEAL—I move that the recommendation of the Executive Committee in regard to the salary of the Secretary be adopted.

THE PRESIDENT—Mr. Denniston will please read what the recommendation is.

MR. DENNISTON—The Committee recommend that the salary of the Secretary and Treasurer be fixed at $300 per annum.

MR. HELME—I move that the recommendation be amended by making it $400. The work of the Secretary is very considerable, and I think it is worth every cent of that sum. If we want the work done well we ought to be willing to pay for it. I do not believe in having the work done in a slipshod way, and I do believe that by paying a fair price for it we can have it well and creditably done.

MR. DENNISTON—The action of the Committee upon this subject was, in substance, that we did not propose to make offices to be contended for. It is not proposed that any member shall make money out of the Association. The matter was brought up in committee and fully discussed. Five hundred dollars was proposed, but it was decided by the Committee that $300, which is equal to $25 a month, would be a fair compensation, as there is not a month's work in the whole business. It will take, undoubtly, a great deal of time if the Secretary is to go around and hunt up members to write articles to be presented here ; but nearly all that can be done by correspondence. Certainly $300 wlll pay for all the labor, and the right kind of labor, that needs to be done by the Secretary and Treasurer. As to the amount of funds in the Treasurer's hands, perhaps it would be better to reduce the annual dues than to have a surplus to be divided or got rid of. If we cannot dispose of our surplus in any other way than by paying

high salaries to officers, it would be perhaps better not to have so large a membership, and not have so large a surplus.

MR. NETTLETON—I would like to say a few words upon that subject, with the permission of the Association. I have been Secretary and Treasurer for several years, and I believe I have some knowledge of what is required of the Secretary. I do not think that $500 is at all exorbitant for performing the duties of Secretary as they ought to be performed.

MR. HARBISON—I hope the amendment will not pass. The matter was very carefully considered and adopted in the Executive Committee; and it was unanimously decided that $300 was sufficient compensation for the services of the Secretary of this Association, and for such work as the Association had every right to expect. It has been suggested that a good deal of time was necessary to run around among members. Well, Mr. President, I do not by any means want to intimate that I think any part of the duties of the Secretary have been neglected, or have not been carefully and satisfactorily performed, by reason of the exertion among members in the way of getting papers prepared, and in the way of having interesting meetings; but I think, as Mr. Denniston has suggested, that all that business can be done by correspondence. Personally, I do not believe that there is over a month's work for the Association during the whole year. The work is of such a nature that it can be done by piece-meal, which does not take a great deal of time, and which does not interfere in any way with the business of the Secretary. I do not mean to assent to the possible construction of Mr. Helme that the business of the Secretary, for which we have heretofore only paid $300, has been done in a slipshod way. I do not think he intended to cast any such reflection as that upon our Secretary, although his words certainly bear that construction. For my own part I am sorry to have any member receive any impression, or to believe that the work has been done in any such way as that.

MR. HELME—Do not trouble yourself about the construction of my words.

MR. HARBISON—I am not the one to trouble myself about the construction of your words. I simply say that they are

undoubtedly susceptible of that interpretation. I think the business has been done as well for $300 as it could be done; and I think that it is quite a sufficient sum to pay for it. I think there are a large number of members of the Association who are capable of filling the place at that remuneration, and who are quite willing to do so. I think it is a wrong principle to establish a salaried position among us which will be contended for on account of the high payment for the services rendered. Believing as I do, that $300 is an amply sufficient compensation for the duties of Secretary and Treasurer, I hope the amendment will not pass.

MR. HELME—I by no means mean to intimate that I thought the work to have been done in a slipshod fashion; and I do not believe that any member of the Association thought that I meant so to imply. I know the business has been done by our present Secretary in a way that could not be excelled. I know, further, that when the Association was first organized the work of the Secretary was very slight. But the membership is increasing every year, and, of course, as the membership increases, the labor of the Secretary increases likewise. I know this, also, that if you pay a low salary you will get slipshod work done. Nothing, we all know, tends so much to produce good work as a good price. If we pay a good price for the work we will get men of brains to do it, and get it done in such a way that it will be a credit to our Association and to our profession at large. The only way to get this class of work done is to pay a fair remuneration for it. If you pay a low salary you will get slipshod work. There is nothing truer than this, I apprehend. In saying that, however, I by no means mean to cast any imputation on our Treasurer, or to say that heretofore we have had slipshod work done.

THE PRESIDENT—The question now is upon Mr. Helme's amendment.

The amendment was lost.

THE PRESIDENT—The question now recurs on the original recommendation of the Committee, that the salary of the Secretary and Treasurer be fixed at $300 a year.

The recommendation was adopted.

MR. DENNISTON—I now call up the amendments which were recommended last year by the Executive Committee. The first is with reference to the name of the Association. The amendment proposed was, "The name of the Association shall be 'The American Gas Light Association.'" I move that that amendment be adopted.

The amendment was adopted.

MR. DENNISTON—I move that the second recommendation of the Executive Committee proposed last year be adopted—namely, that Section XVII be amended by striking out "in the City of New York," etc., and leaving it as follows:

"The annual meeting of the Association shall be held on the third Wednesday in October of each year, at 10 o'clock A. M., at such place as shall be designated by the Association at the previous annual meeting."

In other words, it simply provides for changing the place of meeting. It provides that it shall not necessarily be in the city of New York, unless it is so ordered.

MR. HARBISON—It has been suggested that the month in which the meeting shall be held may be changed. The matter was discussed in the Executive Committee; and if there are any number of members of the Association that desire to have any change made in that respect, I think now is the proper time to have the matter discussed. I simply call the attention of the gentlemen of the Association to this change, in order that they may have an opportunity of expressing their views in relation to it.

THE PRESIDENT—I will say that my attention was called to this matter a few days since. I was requested by a gentleman, who would have been glad to be present at this meeting, to ask that the meeting be changed to May. He said it was impossible for him to attend in the Fall, as he was busy in preparing for his winter's work; but that it would be entirely convenient for him to be present in May or June. We are at the beginning of the winter season, and are entering upon active preparation for the year's work; and it is quite possible that many of our members may be so much engaged that they find it impos-

sible to attend in the Fall. I mentioned the matter this morning at the meeting in Executive Committee, and it was somewhat discussed.

MR. C. A. WHITE—I would like to inquire of the President if an amendment of that kind would not have to be proposed at this meeting and acted upon at the next

THE PRESIDENT—I am inclined to think that an amendment of that kind would have to lie over, although there may be some question whether a simple change of the month of meeting could not be acted upon by the Association at this time.

MR. WHITE—I suppose it could be done by the Association suspending the rules by unanimous consent. I think it would require that, however.

THE PRESIDENT—Whether a proposition to adopt a simple amendment of that kind, namely, to strike out one month and put in another, would require to lie over until next year, I am somewhat in doubt about. It seems to me, however, that the letter of the Constitution would require that the proposition should lie over for a year, although it does not seem to me to be the spirit of it. It is, however, for the Association to decide. The question now is upon the adoption of the proposition to strike out in Section XVII, the words "in the City of New York," so that the article will read:

"The annual meeting of the Association shall be held on the third Wednesday of October of each year, at 10 o'clock A. M., at such place as shall be designated by the Association at the previous annual meeting."

Carried.

MR. DENNISTON—I move that the next recommendation of the Committee proposed last year be adopted, namely, to amend Article XXVIII., so as to read:

"No member who shall be two years in arrears shall be entitled to vote or to participate in the deliberations of the Association."

MR. HARRISON—It seems to me two years is a pretty short time. We have already taken some action in regard to how

members maybe dropped from the rolls. As long as members are allowed to remain upon our list, and are not dropped by vote of the Executive Committee, I think they ought to be present in the deliberations of the Association.

MR. DENNISTON—I do not know whether there was much talk about this amendment in the Executive Committee or not; but the object of this amendment is to prevent members from coming here and taking the floor upon questions that come before us, who are not disposed to keep up the finances. Two years is certainly long enough, in all reason, to allow any member to avail himself of the privileges of this Association, without paying for them. We propose to pay our way, and some members, like Mr. Curley, have not only had their initiation fee paid for them, but have paid again for the privilege of taking part in our discussions. I think two years is quite long enough for any member to go without paying his annual dues.

MR. HELME—It strikes me that two years is very liberal, and I shall certainly vote for the amendment.

THE PRESIDENT—The question is upon the adoption of the amendment to Article XXVIII, which has already been read.

The amendment was adopted.

MR. DENNISTON—I move the adoption of the last amendment proposed by the Executive Committee last year—namely, to amend Section XI, by adding to the same the following:

"And that a change of at least one Vice-President, one member of the Finance Committee, and two members of the Executive Committee, be made at each annual meeting of the Association."

Without occupying the time of the Association in discussing this amendment, I will merely say that it was presented at the last meeting in order to show to the Association that it was not desirable that the same officers should hold over every year. It was decided at a very full meeting of all the officers at the Executive Committee last year that none of them would be considered candidates for the position unless the nomination and election were accorded to them voluntarily. It was distinctly understood among the officers that there was to be

no hard feeling whatever in regard to the matter, and that their names were not to be presented if there was the slightest contest of any kind. The object was, and is, to secure rotation in office, and I hope the amendment will be adopted, and that this change will be made. I think it is conducive to the best interests of this Association that there should be such rotation in office, and there should be new members upon the Finance and Executive Committees each year. I think it will be found to work more satisfactorily if such changes were made, both in the officers and in the members of the Committees each year.

THE PRESIDENT—Without making a speech, I would like to say, as additional to the remarks of Mr. Denniston, that I heartily agree with him ; and think this amendment ought to be adopted. I was present at the organization of this Association, and have had something to do with it every year except one. I believe I have held the position I now hold, of First Vice-President, from the organization of the Association until this time ; and when it was suggested that this amendment ought to be adopted I heartily agreed to it, and I still heartily agree to it, and think that there should be rotation in office. And, so far from there being any feeling in regard to the matter upon my part, I should be very glad to be relieved and have somebody put in my place. The question now is upon the adoption of the amendment.

The amendment was adopted.

MR. C. A. WHITE—I would like to ask for a unanimous suspension of the rules, in order that the Chair may appoint a Committee now to deliberate on names for officers for the ensuing year. We can then take up the ordinary reports and go on with them, the regular order of business being suspended temporarily. I therefore move you, sir, that the Chair appoint a Committee of five to nominate officers for the ensuing year.

Carried.

MR. NETTLETON—Before we go any further, it is important that the Committee of Arrangements should know the names of the several members present; and they have requested me

to furnish them with a list. I do not know of any easier way of getting it than by calling the roll.

THE PRESIDENT—I think it will probably be better to have the roll called. While it is being called it may be that some gentlemen have stepped out; and if any members present know of that fact, they will please answer for the absentees when their names are called.

Roll was then called, and the following members were present:

HONORARY MEMBERS.

G. W. Dresser, New York City, N. Y.

ACTIVE MEMBERS.

Africa, J. S.,	Huntingdon, Pa.
Allen, A. L.,	Poughkeepsie, N. Y.
Allyn, H. A.,	Cambridge, Mass.
Allmand, C. S.,	Norfolk, Va.
Andrew, J.,	Chelsea, Mass.
Archer, B. F.,	Camden, N. J.
Bates, J. W.,	Hoboken, N. J.
Barret, A. H.,	Louisville, Ky.
Battin, Isaac,	Albany, N. Y.
Baxter, W. H.,	Petersburgh, Va.
Breese, E. M.,	Detroit, Mich.
Brown, T. R.,	Philadelphia, Pa.
Burtis, P. T.,	Chicago, Ill.
Budd, H.,	Philadelphia, Pa.
Baumgardner, J. H.,	Lancaster, Pa.
Cabot, G. D.,	Lawrence, Mass.
Cadwell, W. D,	Nashua, N. H.
Cartwright, H.,	Philadelphia, Pa.
Cartwright, J.,	Fishkill, N. Y.
Cartwright, M.,	Rochester, N. Y.
Cartwright, W.,	Oswego, N. Y.
Chambers, J. S.,	Trenton, N. J.
Coggshall, H. F.,	Fitchburg, Mass.
Cornell, T. C.,	Yonkers, N. Y.
Cowing, J. H.,	Buffalo, N. Y.
Crafts, D. W.,	Northampton, Mass.

Crenshaw, N. B.,	Philadelphia, Pa.
Cushing, O. E.,	Lowell, Mass.
Curley, T.,	Wilmington, Del.
Cochrane, C. W.,	Gloucester, Mass.
Davis, F. J.,	Waltham, Mass.
Denniston, W. H.,	Pittsburg, Pa.
Diall, M. N.,	Terre Haute, Ind.
Dock, Gilliard,	Harrisburg, Pa.
Dwight, G.,	Springfield, Mass.
Edgerton, H. H.,	Ft. Wayne, Ind.
Farmer, W.,	New York City, N. Y.
Fish, H. H.,	Utica, N. Y.
Floyd, J. R.,	New York City, N. Y.
Forstall, T.,	New Orleans, La.
Frost, W. H.,	Plymouth, Mass.
Fodell, W. P.,	Philadelphia, Pa.
Fowler, J.,	Philadelphia, Pa.
Gardner, William,	Pittsburgh, Pa.
Gates, F. W.,	Hamilton, Ont.
Gerould, L. P.,	Newton, Mass.
Goodwin, W. W.,	Philadelphia, Pa.
Greenough, M. S.,	Boston, Mass.
Griffin, J. J.,	Philadelphia, Pa.
Hanford, L. C.,	Norwalk, Ct.
Harbison, J. P.,	Hartford, Ct.
Helme, William,	Philadelphia, Pa.
Hookey, G. S.,	Augusta, Ga.
Hopper, Thomas C.,	Philadelphia, Pa.
Isbell, C. W.,	New York City.
Jones, E. C.,	South Boston, Mass.
Littlehales, T.,	Hamilton, Ont.
McCauley, L. G.,	Westchester, Pa.
McElroy, J. H.,	Pittsburgh, Pa.
McIlhenny, G. A.,	Washington, D. C.
McIlhenny, John,	Philadelphia, Pa.
McDonald, William,	Albany, N. Y.
Merrimon, J. D.,	Pictou, N. S.
Munzinger, P.,	Philadelphia, Pa.
Murphy, H.,	Sing Sing, N. Y.

Morris, H G.,	Philadelphia, Pa.
Merrifield, P. S.,	Troy. N. Y.
Neal, G. B.,	Charlestown, Mass.
Nettleton, Charles,	New York City.
Nettleton, C. H.,	Derby, Ct.
Newell, J. W.,	New Brunswick, N. J.
Norton, A. M.,	Nashua, N. H.
Odiorne, F. H.,	Boston, Mass.
Pearson, W. H.,	Toronto, Ont.
Peebles, Philip,	Quebec, Ca.
Perry, A. D.,	Rochester, N. Y.
Pishon, T. J.,	Roxbury, Mass.
Price, W. H.,	Cleveland, Ohio.
Prichitt, S.,	Nashville, Tenn.
Pratt, J. C.,	Jamaica Plains, Mass.
Reed, G. K.,	Lancaster, Pa.
Richardson, G.,	Wilmington, Del.
Rogers, J. F.,	Jamaica Plains, Mass.
Rollins, J. H.,	Worcester, Mass.
Root, F. M.,	Connersville, Ind.
Ramsdell, G. G.,	Vincennes, Ind.
Richardson, A. W.,	North Adams, Mass.
Roxbury, J.,	Alexandria, Va.
Scott, I. R.,	Waltham, Mass.
Slater, A. B.	Providence, R. I.
Sherman, F. C.,	New Haven, Ct.
Smith, M.,	Wilkesbarre, Pa.
Spaulding, C. F.,	Brookline, Mass.
Spear, J. Q. A.,	Dorcester, Mass.
Starr, J. M.,	Richmond, Ind.
Stedman, W. A.,	Newport, R I.
Stiness, S. G.,	Pawtucket, R. I.
Swain, R. B.,	Cape May, N. J.
Turner, T.,	Charleston, S. C.
Van Benschoten, Chas. C.,	New Rochelle, N. Y.
White, C. A.,	Rochester, N. Y.
White, E. V.,	Portsmouth, Va.
White, W. H.,	Brooklyn, N. Y.
Wood, Austin C.,	Syracuse, N. Y.

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Mr. A. C. Wood, Mr.
Mr. P. T. Burtis, and

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that can be done, except by altering the Constitution. The ordinary course of business, however, as suggested by Major Dresser, remedies the difficulty referred to by Mr. Harbison, for the reason that the report of the Secretary and Treasurer is not acted upon until it has been audited by the Finance Committee.

MR. HARBISON—I think I am right in what I have stated, and that Major Dresser has not stated the order of business as it is prescribed by the Constitution. If I read Article XVI right, it says : "The Finance Committee shall meet on the day of each annual meeting of the Association, at least one hour before the opening of the meeting, to receive from the Treasurer a statement of his accounts, and audit the same. They shall hold such other meetings, from time to time, as the interests of the Association may require." That is the order of business as prescribed by the Constitution ; and if it is adhered to it is the duty of the Finance Committee to meet and examine the report of the Treasurer before the opening of the meeting of the Association, and to audit his accounts. His report and his accounts are not referred to the Finance Committee by the Association for their approval, as stated by Major Dresser. I therefore made the suggestion that it seemed to me that the order of business in this regard should be reversed, and that the report of the Finance Committee upon the Treasurer's report should be presented to the Association and acted upon before the report of the Treasurer was read.

MAJOR DRESSER—I suppose the object of that is this—that before the Treasurer could make up his report, the bills which had been rendered must be approved by the Finance Committee, and he wants the approval of the Finance Committee to those bills, so as to make up his account in proper shape.

THE PRESIDENT—I do not see that there is the least difficulty about the matter.

MR. HARBISON—In reply I would simply state that, practically, the account of the Treasurer is closed upon the 30th of September, by vote of the Association. He does not report anything that has taken place since that time, and the Finance

Committee have nothing to do with his transactions subsequent to that date.

THE PRESIDENT—There is no practical difficulty about the matter, so far as I can see. We can read the report of the Treasurer, and lay it upon the table, and then can read the report of the Finance Committee ; and after the facts are all before the Association, as presented by the report of the Finance Committee, we can take up the report of the Treasurer from the table and do with it what seems best.

MR. DENNISTON—I was about to say that we need not do anything with the Treasurer's report, except to hear it, and then the report of the Finance Committee is in order.

THE PRESIDENT—At any rate, I see nothing to do except to hear Mr. Nettleton's report, according to the order of business prescribed by the Constitution, which order we must follow.

REPORT OF THE TREASURER.

Mr. Nettleton then presented his report as follows :

Receipts.

Cash balance from last year..	$624 60	
Rec'd for initiation fees .	130 00	
" annual dues........	747 00	
		$1,501 60

Disbursements.

Expenses of Meeting, 1878...$	60 00	
Salary of Sec'y and Treas., one year.....................	300 00	
Postage, Expressage, Printing, etc., etc	43 75	
		403 75
Balance to new Account..		$1,097 85

It is deposited in the Metropolitan Bank of New York City, in the name of the Association, subject to the check of the Treasurer. There are six honorary members. Of active members, liable for dues, there are 193 ; making a total of 199 on the roll.

THE PRESIDENT—You have heard the report of the Treasurer. If there is no objection it will lie upon the table until you take it up for action.

MR C. A. WHITE—I move that it be referred to the Finance Committee, and if found to be correct to be accepted and placed on file.

Carried.

MR. NETTLETON—I thought it would be interesting to the Association to have a sort of review passed of the financial history of the Association; and so I went over the books, commencing with the year 1873-4. That was the time when Mr. DeMill came in as Treasurer. Prior to that time there is no record that I know of which will furnish exact data. For the year 1873-4 there was received by the Association, composed then of 60 members, for initiation fees, $600. There was received for annual dues, $5 each from 14 members, showing that that was merely the commencement, or substantially the commencement, of the organization. The total for the year 1873-4 was therefore $670. For the next year, 1874-5, there were 32 initiation fees received, and 63 members paid their annual dues of $5. In the year 1875-6 there were 33 initiation fees paid, and 114 members paid their annual dues of $5. For the year 1876-7 there were 20 initiation fees paid, and 151 members paid their annual dues of $5. In 1877-8 there were 16 initiation fees paid, and 147 annual dues of $5. In the year 1878-9, before the 30th of September, there were 13 initiation fees at $10, and 149 annual dues of $5 each. I should state that since the 30th of September there have been paid annual dues to the amount of $110; and I have received $3 for copies of the proceedings of the Association from members, at $1.50 each, which was the price fixed by the Association. There are 28 members liable to pay annual dues, which were unpaid at the commencement of this meeting.

THE PRESIDENT—I am sure that every member of the Association is very much obliged to Mr. Nettleton for this exhibit of the financial progress of the Association since its organization.

REPORT OF FINANCE COMMITTEE.

THE PRESIDENT—The report of the Finance Committee is now in order.

MR. HARBISON.—In the absence of Mr. Chambers, the Chairman of the Finance Committee, I beg leave to present the following report :

The undersigned have examined the accounts of Charles Nettleton for the year ending September 30, 1879, and find the same correct, with a balance in the Treasurer's hands of $1,097.85.

(Signed) JOHN R. CHAMBERS,
JOHN P. HARBISON,
Finance Committee.

MR. DENNISTON—I move that the report of the Finance Committee be received and placed on file.

Carried.

MR. NEAL—I should state for the information of the Association, that the amount to be paid by the new members who have applied for admission will be $160.

REPORTS OF SPECIAL COMMITTEES.

THE PRESIDENT—The next item of business in order is the reports of special committees.

Report of the Committee on Printing.

CAPT. WHITE—Mr. President, the Committee on Printing respectfully beg leave to submit the following report :

To the American Gas Light Association :

GENTLEMEN:—The Committee charged at the last annual meeting of the Association with the duty of publishing the proceedings of this body since the publication of Vol. II, respectfully report that they have completed the duty intrusted to them to the best of their ability, and now present for the inspection of the members Vol. III of the proceedings of the American Gas Light Association, feeling that it is in every way

worthy of their acceptance, and trust that it may be received as an evidence of the careful attention bestowed upon it by your Committee.

That the labor of preparing such a mass of matter for publication is no light task at best, must be self-evident, and needs no elaboration at the hands of your Committee; but these labors fortunately were lightened in that no instructions were given to excerpt any irrelevant matter from the reported doings of the Association, and from the fact that the careful stenographic reports of these meetings in the *American Gas Light Journal* are such faithful reproductions of the papers read and discussions had on them. This is illustrated in the fact that while your Committee publicly invited the members to revise any matter which had been published, and yet did not fully convey their ideas or embody them in their own language, but one or two gentlemen found it necessary to amend the reports as given in the *Journal.*

Your Committee asked for and received bids from several publishing houses for printing and binding 600 volumes of 432 pages each (the original bids your Committee desire to place on file as a portion of their report), the *American Gas Light Journal* being the lowest bidder, the work was awarded to the proprietors of that journal, and in the estimation of your Committee, the work has been acceptably performed.

In preparing the volume your Committee found itself called upon to use its judgment in a matter that had been overlooked by the Association, namely, that of securing "cuts" to illustrate the lecture upon the electric light, delivered before the Association by Prof. Henry Morton. Without the illustrations this valuable and comprehensive lecture would be shorn of much of its interest, and many of its explanations be but imperfectly comprehended. It was therefore decided to include such "cuts" in the cost of publication, and by a liberal arrangement on the part of the proprietors of the *American Gas Light Journal* the use and ownership of the cuts owned by that paper passed to the Association, so that the volume completed, covering the proceedings of 1877 and 1878, containing 400 pages, printed in large type and neatly bound, cost

for the 600 copies delivered to the Secretary, $640, or a cost per copy of $1.06 6-10. Volume II, containing 264 pages, cost $1.04 7-10 per copy. In view of these facts, your Committee feels that its work has been economically performed, and will prove a valuable addition to the volumes already published, as there can no longer be a doubt about the benefit of thus putting in a permanent, handy form, the proceedings of this Association.

Your Committee cannot close its onerous duties without calling the attention of the Association to the exacting character of the work committed to the Printing Committee, especially the part borne by the Secretary of this body, to whose tireless attention, patient systematizing of details, and general solicitude that the book should be without blemish, most of the success of the publication is due. Those of us who are not familiar with the preparatory work of such a volume as we now lay before you, can form no idea of the toil and time involved; but in this, at least, all must agree, that great credit is due to the worker in such a cause.

Respectfully submitted,

CHARLES ROOME,
WM. HENRY WHITE,
Printing Committee.

On motion of Mr. C. A. White, the report was accepted and placed on file and the Committee discharged.

MR. C. A. WHITE—I move, Mr. President, that a vote of thanks be tendered to the Printing Committee for the highly successful and satisfactory manner in which they have performed their arduous duties.

Carried.

REPORT OF THE COMMITTEE ON UNACCOUNTED-FOR GAS.

MR. C. A. WHITE—On behalf of the Committee on Unaccounted-for Gas, I beg leave to submit the following report:

To the American Gas Light Association:

GENTLEMEN:—Your Committee, to whom was referred the subject of unaccounted-for gas, and a method by which the

same could be reported by the various companies in an equable manner, would most respectfully report that it was impossible to get all the members of the Committee together; but a majority of the same had several meetings and used their utmost endeavors to make a full and final report on the subject, but, I regret to say, were unable to adopt any method which, whilst being simple of application, should be equally fair to all companies.

The only system that could be in any way considered as likely to come within the scope of the above was that of taking some one diameter of pipe as a standard diameter, and raising or lowering all others to that standard.

This presented these difficulties:

1st. That it necessitated the preparation of a large number or series of formulæ for the purpose of bringing the various sizes of pipe to the adopted standard.

2d. The necessity of some method of reaching an average pressure.

3d. That even after the formulæ had been constructed and the pressure regulated, there yet remains the fact of the difference in the number of services per mile of main, requiring to be worked out and equalized by proportion.

The idea of adopting some one diameter, such as six inch or eight inch, to be a standard, is certainly a feasible one, as formulæ can be prepared and furnished to the engineers of the various companies, which would require of them but a few moments' labor to bring their mileage of different sizes to a mileage of standard diameter, providing that all the companies used the same average pressure; but there are few companies that are so situated, consequently requiring the construction of a series of formulæ for the various averages of pressure.

The construction of such a formulæ overcomes the second difficulty, and the third is easily disposed of by simple work in proportion.

I must apologize to the Convention that I am not able to give a more complete report, including a series of the formulæ proposed; but I have had but little time for thought upon this

subject since the last meeting of the Committee. Our city has been afflicted with an attack of reform, and I have been kept very busy taking out and rearranging the city lamps—occupying several hours per day—which, in connection with other work, has prevented me from doing all I could have wished. I have some of the formulæ prepared, taking six (6) inch pipe as the standard diameter, and fifteen-tenths as the average pressure; but, not having a complete list, did not deem it worth presenting to the Convention at this time.

If the Convention deems that the steps already taken are in the right direction, or that the above proposition, when completed, would be of any advantage or value to the Association, I should only be too happy to continue the investigation and complete the necessary formulæ.

[Signed] CLEMENT A. WHITE.
A. C. WOOD.

CAPTAIN WHITE—I move, Mr. President, that the Committee on Unaccounted-for Gas be continued, and be requested to make further investigations and report at the next annual meeting.

Carried.

MR. NETTLETON—I am not aware that there are any other committees to report. I have here a communication to the President of the Association, which I think it proper to read. It is from the Philadelphia Gas Trust, and is as follows:

Gentlemen :—We cordially extend to the American Gas Light Association an invitation to visit all the gas works in Philadelphia under the control of the Board of Trustees.

Very respectfully,

THOMAS NOBLE, Registrar.

MR. CARTWRIGHT—I move that the invitation be accepted at the convenience of the members, and that the thanks of the Association be tendered for the invitation.

Carried.

MR. HELME—It might be proper to say at this point that the Secretary of the Franklin Institute, before we convened

here to-day, requested that I should extend to the members of the American Gas Light Association an invitation to attend their monthly meeting, which takes place in this room this evening at 8 o'clock.

MR. C. A. WHITE—I move that the invitation be accepted at the convenience of the members, and that the thanks of the Association be tendered to the Secretary of the Franklin Institute for the invitation.

Carried.

MR. HELME—I think the members will find the meeting here to be very interesting. The general order of business is first gone through with, and then various subjects, of a scientific nature and otherwise, are brought up, discussed, explained, and illustrated. I would state that at this time a year ago we were all interested and excited upon the subject of the electric light. We did not know exactly where we stood. Up to that time large gas burners had not been experimented with to any great extent. We all know that some experiments have been made in this direction upon the other side of the Atlantic, and some of the large burners that were used there have found their way to this country; and I desire to say, for the information of the Association, that there is a large Wigham burner which was used on Westminster Bridge in competition with the electric light, and which was decided to be preferable to the electric light. It is put up at 1117 Cherry street, in this city, and will be burned this evening and next evening for the gratification of such members of the Association as wish to look at it. It is a 28-jet burner. They give it a measurement in London of 51.4 cubic feet per hour, and a power of 429 candles, cannel gas. It is a new thing to us, and in our tests we have only been able to pass about 35 feet, and it seems to give a candle power of about 250 or 275 candles. It will be burned to-morrow evening and every succeeding evening until 12 o'clock, at the point I have named; and if any one wishes to go and see how one of those burners operates, he will have an opportunity to do so. They claim to have taken photographs with them in London. The one I have spoken of, however, is not one of

the largest. They have one of 48 burners, which I believe was used for that purpose.

THE PRESIDENT—Undoubtedly every member of the Association will accept that invitation. It is very desirable to learn all we can about the new burners.

MR. HELME—It merely serves to give us an idea of what may be accomplished in that direction. It is a large light, and certainly very much preferable to the electric light.

MR. NEAL—I move that we proceed to the election of officers.

REPORT OF COMMITTEE ON NOMINATION OF OFFICERS.

MR. WOOD—On behalf of the Committee on the Nomination of Officers, I beg leave to submit the following report:

The Committee recommend for President of the Association, W. H. Price, of Ohio.

For Vice-Presidents, General A. Hickenlooper, Ohio; John P. Harbison, Connecticut; George A. McIlhenny, D. C.

For Secretary and Treasurer, Wm. Henry White, New York.

For Finance Committee, John S. Chambers, New Jersey; Theobald Forstall, Louisiana; A. B. Slater, Rhode Island.

For Executive Committee, Henry Cartwright, Pennsylvania; F. C. Sherman, Connecticut; A. C. Wood, New York; George S Hookey, Georgia; James M. Starr, Indiana; P. T. Burtis, Illinois.

Respectfully submitted,

A. C. WOOD,
GEORGE DWIGHT,
P. T. BURTIS,
THEOBALD FORSTALL,
W. A. STEDMAN,
Committee.

MR. C. A. WHITE—I move that the report of the Nominating Committee be accepted and the Committee discharged.

Carried.

MR. C. A. WHITE—I move that the Secretary be authorized

to cast the ballot of the Association for the gentlemen named by the Committee as officers for the ensuing year.

There being no objection, the Secretary then proceeded to cast the ballot of the Association for the gentlemen named as officers for the ensuing year. Major Dresser was appointed teller.

MR. WOOD—I trust that it is understood by the Association that General Roome and Mr. Nettleton both peremptorily decline re-election.

MAJOR DRESSER—Mr. President, the teller appointed to receive and count the votes of the Association for officers for the ensuing year, begs leave to report that he has examined the ballots, and has found the gentlemen whose names were presented by the Nominating Committee to be unanimously elected.

THE PRESIDENT—I have been in very great doubt whether I ought to thank you for this election. I certainly do thank you, gentlemen of the Association, most heartily and sincerely for this evidence of your good will and esteem; but I felt very greatly inclined to go again into the ranks. I have reached an age when I have got beyond the petty ambition to occupy a conspicuous position. I would rather have had the opportunity to be at liberty to make motions and talk a little, than to be tied up as I am in this place. It may be, however, for the good of the Association that I am tied up in this way. I might talk too much, and make too many motions. Since, however, you have chosen me to occupy this position, I will endeavor to perform its duties to the best of my ability, and I desire once more to return my thanks for this expression of your preference. [Applause.]

PAPERS.

THE PRESIDENT—The next thing in the order of business is the reading of papers.

MR. C. A. WHITE—As there are but a few minutes before the hour fixed for adjournment, I think it would be hardly proper to take up the reading of papers at this time. If a paper is read now, and we take a recess until 3 o'clock, many

things which might present themselves to our minds as the papers were being read, will have been forgotten during the intermission. It therefore seems to me to be proper to defer the reading of the papers until we assemble this afternoon I think we had now better adjourn until 3 o'clock, unless there is something which requires our special attention.

CAPTAIN WHITE—Before that motion is put, I desire to say that I think the Association has overlooked one very important matter. The President and Secretary of this Association, who have served us so faithfully and acceptably for the past four or five years, now, of their own free will, retire from office. It seems to me, sir, that we are forgetting our manners in allowing these gentlemen to step down from the positions which they have filled from year to year to our honor and credit, without expressing to them our sincere and hearty thanks for the manner in which they have administered the duties, oftentimes onerous, of their several offices. I therefore move that the thanks of this Association be tendered to the retiring officers, our honored President, General Charles Roome, and to our able and efficient Secretary, Mr. Charles Nettleton. [Applause.]

THE PRESIDENT—I am sure that every member of the Association will respond most heartily to the motion that has just been made, and I am very glad that Captain White has had the thoughtfulness to bring it to our attention. We certainly ought not to adjourn without expressing our high appreciation of the services rendered by the gentlemen who retire from office to-day. I am sure we will all of us gladly bear testimony to the high esteem with which we regard the honored gentleman who has so long filled the office of President, as well as to the efficient, zealous and satisfactory manner in which the duties of Secretary and Treasurer have been discharged by the gentleman who now voluntarily retires from the office. I think that to him, perhaps more than to any other man, is due in a large measure the success which has followed the organization of this Association. We have sometimes discussed our Secretary pretty freely—not in the way of criticism, but in the way of commenting upon the amount of compensation to which he

was entitled for his services. A question has from time to time been raised in regard to the amount of his labors, but, for my own part, I do not think that the Association has ever really appreciated the amount of labor performed by our Secretary, and the obligations we are under to him for the very excellent position which we, as an association, occupy to-day. And, while we all recognize and appreciate to the fullest extent the distinguished services which our President has rendered, I think we must all admit that to Mr. Nettleton, more than to any other man, is due the success which has attended our labors thus far. [Applause.] I am glad, gentlemen, that this expression of my sentiments meets with your approval. For my own part, I have never felt that the services of the Secretary have been very highly paid for; but in that I have had the misfortune to differ with some of the gentlemen present. However that may be, I am sure they will agree with me that the duties of Secretary have been performed with a degree of excellence entirely beyond criticism. It is not for me, however, to say anything upon the subject of salary. If the Secretary is satisfied, we certainly ought to be.

It gives me great pleasure, gentlemen of the Association, to put the motion made by Captain White, for I am sure that it meets with the most hearty and unanimous concurrence of every gentleman present to-day.

Mr. Neal—I suggest, Mr. President, that the thanks of the Association be tendered to these gentlemen by a rising vote.

The motion was adopted. Every member of the Association rose to his feet, and after the vote was taken there was loud and continued applause.

Mr. Nettleton—Gentlemen of the Association: If General Roome were here, he could respond to the action you have just taken in language most fitting and eloquent. Although I belong to a talking profession nominally, talking in public has never been my forte. I can sometimes effect results by acts to my satisfaction, and, I am happy to say—and I know you will understand me as saying it without egotism—that I am reasonably satisfied with the way I have performed the duties of Secretary and Treasurer of this Association. It is highly grati-

fying to me, gentlemen, to know that you are also satisfied with the manner in which these duties have been performed. The warm words of friendship which have been expressed by our President to-day come very close home to my heart, and I can say no more. I thank you. [Applause.]

On motion, the Association then adjourned till three o'clock P. M.

Afternoon Session.

The Association met at three o'clock, pursuant to adjournment.

The President—The first thing in order will be a report from the Executive Committee.

Mr. Neal—Mr. President, the Executive Committee have received applications from several gentlemen, and they recommend their election as members of the Association.

The President—We come now to the serious work of the meeting. We have several papers which have been prepared, and I will now call upon Mr. Sherman to read his paper upon the Relation of Municipalities to Gas Companies.

The paper was then read by Major Dresser, as follows:

THE RELATIONS OF MUNICIPALITIES TO GAS COMPANIES

Within the past few years there has arisen in this country a class of individuals who wish to hurry up the millenium by attacking corporations of a semi-public nature. This feeling manifested itself in the labor riots of 1876, and is at present extremely popular in California. These outbursts are always originated by those who see a short road to wealth by dividing and distributing the savings of others. For political or other reasons, many respectable people join hands with them, and the consequence is that we already hear of a struggle between labor and capital.

That gas companies have received no little attention from these reformers, aided by many who bear honest convictions

that a better state of affairs could be brought about, is evidenced by the slightest perusal of the daily press. Their absurd and foolish statements meet with a ready credence, as is demonstrated by the sympathy and aid extended to all attempts to establish rival companies.

Statistics abundantly prove that competition in the supply of such an article as illuminating gas cannot be sustained. Wherever it has been tried, evils of a nature to more than counterbalance its good qualities have arisen. It has been necessary either to district the territory or absorb it. The people ultimately have to pay for the increased outlay necessary to cover the interest on two or more sets of mains and works, together with the watered capital. But few American cities are large enough to try the experiment, and, if they were, the experience of the largest cities of the old world would not sanction the attempt. It has been abandoned in every instance where tried across the Atlantic, the two most notable examples of which are to be found in London and Paris.

At one time there were fourteen companies in London. In 1860 each one was assigned a district, and since then, by amalgamation, the number has been reduced to five. Of the several companies which at one time existed in Paris, but one now remains. The system of rivalry in the production of illuminating gas has been fully tried in New York State under the fostering influence of the Legislature. The result has been that, although two or more companies exist in nearly all the principal cities of that State, the cost to consumers exceeds that in cities which have but one company to support.

It is safe to estimate that more than double the amount of capital necessary to transact the business is invested in it in New York State, thus weighing it down in such a manner as to prevent its true development and growth.

To add to the difficulties, the unfriendly treatment which most companies receive from municipal corporations should be noted. In most places they are barely tolerated; denied their rights in the streets; their mains and services injured, and leakage increased.

Again, in the matter of lighting the streets, the companies

are crowded in the price below a living rate, and constant carping is indulged in both as to the quantity and quality of the gas furnished.

A partial remedy for this state of affairs can be found in a greater publicity in regard to our business, and leave the intelligent citizen to see for himself the hollowness of the arguments in favor of competing companies. The veil with which we have so carefully surrounded ourselves in the past is in a measure due to the opposition which we are now encountering. It has begotten suspicion and jealousy on the part of our consumers. It has led many to believe that our profits are too great to stand public scrutiny. The future safety of our investments in gas manufacture lies in taking the public into our confidence.

Our business is honorable and useful, and we have nothing that ought to be concealed. With very few exceptions, the customers of gas companies have been honorably dealt with, and the profits have not been more than the risks warranted.

In England, where this whole question has been thoroughly investigated, the companies are allowed by law ten per cent. dividends. An examination of the business in this country would reveal the fact that a ten per cent. dividend is not realized. The uncertainty that hangs over gas investments is an outgrowth of this hostility; engendered by ignorance of the business.

Where a company is prosperous, a constant effort is necessary to keep out opposition, and is often attended with great expense. From its very nature, it is necessary that the business should be a monopoly, but an enlightened self-interest demands that it be one regulated by law. Not only should our gas be subjected to inspection, but our investments, operating expenses, and profits.

This would do away with many of the complaints of our consumers, and insure us from competition. I am satisfied that we must come to this eventually in order to escape ruinous competition and the burdening of the public with the support of unnecessary capital.

Some of you may deny that we, the managers, have any

interest in this subject; but self-interest, if no higher motive, ought to make each of us use his individual influence with his own company in seeking to bring about, in a quiet way, what may eventually be forced upon us in a burdensome form.

The reading of the paper was greeted with applause.

THE PRESIDENT—I think our habit has been, after the reading of papers, to discuss the subject to which they relate, and we invite any remarks that gentlemen may feel inclined to make, either in the way of criticising the paper or giving expression to their own ideas in relation to the subject-matter of the article. It is probably best to pursue the same course in this case, and those members who have remarks to make will now proceed to occupy the time.

MR. NEAL—I think we all so heartily agree with the sentiments expressed by Mr. Sherman in that paper, that none of us have anything to say, except to express our approval.

MR. STINESS—If there are no remarks to be made upon that paper, and if we all agree with the views and conclusions of Mr. Sherman, as has been suggested by Mr. Neal, I move that the thanks of the Association be tendered to Mr. Sherman for the very elear and explicit manner in which he has presented his views.

MR. HARBISON—I hope some gentleman present will make some more extended remarks. What has been said by Mr. Neal and Mr. Stiness is, of course, very good as far as it goes, but it seems to me that the paper is worthy of more extended discussion.

MR C. A. WHITE—It is something like a Methodist meeting; we all say "amen."

MR. McILHENNY—I came in just as the last of the paper was being read, and I do not know what the former part of it contained; but I hope that such a paper as that will not be allowed to pass without discussion. I hope the gentlemen of the Association who have heard the whole of the paper will express their views on the subject.

MR. LITTLEHALES—For my own part, I must say that the paper to which we have just listened is one that has given me

a great deal of information and a great deal of pleasure. It seems to me that it is the key-note of the position in which the gas companies stand in regard to the price of gas. There is a great demand for a reduction in the price of gas all over the country, and that demand can only be complied with, it seems to me, by a little modification of the system that has been heretofore adopted in the conduct of gas companies.

When a company is chartered in Great Britain, it comes under the supervision of a special committee of the House of Commons, which prescribes what the capital of the company shall be. The company is to show what amount of business it expects to do, what their coal and the different items which go to make their product will cost them, and their anticipated profits ; in fact, they have to submit a prospective balance-sheet. After that is done, the committee of the House of Commons decides what shall be the limit of the price, and fix the illuminating power and standard of purity. The municipality has nothing at all to say in the maiter. Parliament gives the charter, and all that the company has to do with the municipality and the only relation they sustain to it, is simply to give them notice of breaking open the streets. While the companies carry out the conditions imposed by Parliament, there is not the slightest chance of their having an excess of capital, or their being interfered with in any way by the municipality. The tendency has been to restrict, as far as possible, the employment of capital so as to have the capital account in a low proportion to the make of gas. The result has been that gas is sold cheaper in England than anywhere else. The investment is perfectly secure, and the consumers, I suppose, are satisfied.

There are a great many considerations which bear upon this question, which will have to be decided before any such regulation can be adopted here. The question naturally arises, whether the same system can be adopted in this country. That, of course, is a question of legislation. If such legislation could be had in this country as would make the investment in gas companies secure and permanent, there would be some inducement for the companies to make their price lower and

restrict their capital. It is, however, a very large and serious question to deal with, and I hope the matter will not be allowed to lie over, but that the question will be thoroughly ventilated. Until there is some uniformity in the legislation, it seems to me we will never reach the point of a reduction in the price that might be reached if proper legislation were secured.

MAJOR DRESSER—Upon the question of the protection which the law gives to gas companies in England, as mentioned by Mr. Littlehales, I would state that formerly, in Liverpool, there were two companies, and a third was projected. The two companies had been in opposition. An application was put in for the organization of a third company, and the promoters of it came before the Committee of the House of Commons for authority to raise capital and go on with the business. The other two companies, who had not previously been particularly friendly to each other, united for the purpose of opposing the organization of the third company, and came before the Committee for that purpose. The Committee heard them all, and finally said to the companies already existing, what would amount to this:

"If you two old companies will arrange your differences and consolidate into one company, as you ought to do, we will take care that there are no more gas companies in Liverpool."

They did so, and Liverpool has but one company. That has been the custom in other cases since this legislation of the British Parliament has been adopted, and consolidation is going on all the time in England where several companies are doing business in the same place.

There is another point in connection with this subject, which Mr. Littlehales has also referred to, and it is one which comes pretty closely home to a good many gas companies in this country, and that is this matter of capital. I have reason to believe that some of the gentlemen who have read the *Journal* know pretty well what my views are on that subject. I have reason to believe that some of the gentlemen present entertain very decided views upon this question, and that they are prepared to express them. There is, in my judgment, too much capital nominally in the business, even in many cases where

there is but one company existing in one place; and it seems to me that there could be no better service rendered to the public, or the stockholders, or to this Association, than for this body of men to put their heads together and see if there is not some way by which the capital represented by the gas-making interests of this country can be reduced to a reasonable basis, and to a just proportion to the amount of the business and to the value of their plant. When we get down to the point that an engineer of a gas company does not have to add a dollar to the cost of every thousand feet of gas sold in order to pay a ten per cent dividend, or in other words, to a point where the capital of the company is reduced within reasonable limits, we will have arrived at a point, I think, where the reduction of the price of gas will be entirely practicable and profitable.

The trouble about the matter is that those who seek to bring about this change will encounter an opposition that will be very hard to overcome. When it is demonstrated to the satisfaction of the public, and to everybody, that gas companies are not getting more than a fair price for their gas, and are not making exorbitant profits out of their business, nobody is going to put more money into it. I think it is a very important point, and that it deserves to be very carefully considered by the Association.

I hope you will excuse me for taking up so much of your time; but, if this matter is going to be agitated at all, and if it is desirable, as it certainly is, that any reform should be brought about, it seems to me that this Association is better adapted to inaugurate such a reform, and to carry it into effect, than anybody else.

Mr. Coggshall—I think it is a very important subject; but, to my mind, the matter really rests with the gas companies themselves. If the stockholders of gas companies would be willing to reduce their capital, and be satisfied with a reasonable dividend of eight or ten per cent., with taxes paid, which is, to my mind, a dividend sufficient for any stockholder, I think the solution of the difficulty would be reached. As I say, in my judgment, the gas companies themselves have this question in their own hands. I would refer, as an illustration

of that, to the gas company of the city of Lowell, which is represented here to-day. There they sell their gas at $1.80, and I should not be afraid to defy any competing company to come in there and locate. Opposition companies will not go to any such place as that. So that, if gas companies would consent to a fair and reasonable reduction of their capital, and would sell their gas at a low figure, and be satisfied with reasonable dividends, it does not seem to me that there would be any difficulty from competing companies. The gas company of Derby, Connecticut, is selling gas, for the size of the place, cheaper than any other company I know of in New England. If the stockholders of the gas companies could be brought to accept the situation, and to manufacture the gas as cheap as it could be manufactured, and sell it as low as it could be sold, there would be no danger of competition.

MR. STEDMAN—Major Dresser has suggested that I should say something upon this point in connection with some statistics of several New England gas companies which have recently been collected. It seems to me the matter, after all, comes down to the question about "belling the cat," that we have all heard of. Who was going to bell the cat? Who will have the temerity to go to the stockholders and say to them: "You have got too much capital; if you are willing to reduce the amount of your stock 33 per cent., and receive 8 or 10 per cent. dividends on the balance, over and above taxes, we can sell gas low?"

Let me premise my remarks by saying, in the first place, that a good many New England gas companies are in the situation of having a very large plant put up by contractors who came in the town for the purpose of making a good pile of money. The works were put up, say, at a cost of $60,000, the builders receiving the stock of the company to the amount of $120,000, $130,000, or $150,000, and a large amount of stock would be issued. Then they would step out and would leave the stockholders to work out the problem of how to manufacture gas, and how to sell it so as to make a dividend on that large amount of capital stock. Having found themselves in a position of that kind, they put in a little water, so that the capital

represents a very large amount per thousand feet sold. In the tabulated statistics referred to, we have the number of thousand feet sold by each company; also the capital stock of each company, and a column showing what the amount of the capital stock is per thousand feet of gas sold per annum. This runs down as low as $1.90 per thousand feet of gas sold, and it runs up as high as $29 per thousand feet sold. So there is, as you will see, a great discrepancy in this respect, and you will also see from that statement what the possibility is of selling gas at a low rate by some of the companies, and, at the same time, make a fair return to the stockholders. The average, I think, is about $9 per thousand feet, or a little under. It is brought down to this low average on account of one or two large companies having a small average, and, of course, it makes the total average low. If you take out the two largest companies of New England, the average would run considerably higher, possibly between $14 to $15.

I believe the time will come when we shall have the matter regulated by legislation, very much as it is in England. But, when we come to do it in that way and our books and accounts are inspected, it may lead to a very considerable amount of criticism. People will say, "What does this $50,000 represent? Here is a statement of your books that a certain amount was divided among your stockholders. Does that represent $25,000 or $50,000 actually put into the company to enable them to enhance their productive power, and to decrease their cost of production; or, does it represent a fictitious value—something that was not actually put in?" Those are criticisms and questions that would undoubtedly be made and asked, were our books and accounts open to the public.

I believe, Mr. President, that it would be of great advantage to the gas companies if they could satisfy the public that they were dealing fairly and honestly with them. But, where gas companies are in the position that I have referred to; where they have watered their stock, and where their stock does not represent the actual value of their plant, and does not represent money actually put in, there will be, of course, some difficulty about having the matter made public, and there will be

some natural repugnance to opening their books for the inspection of the public. But, who shall have the temerity to bell the cat? Who shall have the temerity to go to the stockholders and say, "This dividend, this money that was given to you, we could hardly afford to give. If you will adjust the amount of your stock, and put it upon a fair and reasonable basis, and establish a just proportion between the amount of capital stock and the value of your plant, we shall then be able to sell gas cheap, and pay eight or ten per cent dividend upon the capital thus reduced." If stockholders could be brought to look at the matter in this light, I think there would be little trouble; and, *after the change was made*, the stockholders would be better satisfied, and the consumers certainly much better satisfied. As I said before, I think the best interests of the gas companies would be served if the public were thoroughly convinced that they were fairly and honestly and justly dealt with; and that the cost production was as low as it could reasonably be made, and that gas was sold for only a fair margin of profit.

MR. HARBISON—I agree in part with what Mr. Sherman has said, and only in part. I think that a certain amount of publicity in regard to our affairs is right and proper, so far as the public is concerned. I think the public have rights which gas companies are bound to respect; but there is a limit to those rights. I do not think that the public is entitled to know the details of the affairs of the gas companies. I think that in our city the people know as much about the affairs of gas companies as the people of any city in the Union. I do not believe there is any place where the people know any more about the business of gas companies than they do with us. But I do not think that the public should be informed of all the minor details of our business any more than they are informed, or ought to be informed, of the details of any manufacturing company's business. I think the great difficulty that gas companies labor under, in regard to threatened opposition, is due to themselves. I think those gas companies which are thus threatened have not, in a majority of cases, dealt fairly with the public. A company that has its capital stock watered from 40 to 50 per cent., and expects the public to pay a dividend of

10 or 12 per cent. on that watered stock, is not treating the consumer rightly, and I do not think that threatened opposition would hurt them, but would bring them to their senses. I know of some companies that occupy just such a position as that, where opposition was brought about for that very reason. I remember very well, a good many years ago, being told by an officer of a gas company located in a city which it is not necessary to mention, that he had all the people in that town under his thumb, and (laying his thumb on the desk as he spoke) said, "I propose to keep them there." I replied to him: "Your thumb is very large, or the people very, very small." The history of that place and that company has since shown that the man made a mistake. That is only one illustration of what I mean. I think if gas companies conducted their business as individuals do, fairly and equitably toward the public, there would be very little difficulty in the way of opposition and blackmailing, or anything of that kind. Hartford has not been free from attempts to blackmail the gas companies, but no one has succeeded. No one has ever received a penny of blackmail from the company I represent, directly or indirectly. Attempts have frequently been made to extort blackmail from us, but we have gone directly to the Legislature, and all the bills we have ever paid in this direction have been our lawyers' bills; and they have not been very heavy, because we have been able to go before the Legislature and stand upon our merits, and have not been afraid to answer any questions which the counsel for the opposition, or any member of the Legislature, asked in regard to our business. We have shown them that we conducted our business fairly and legitimately, and that our capital stock represents a bona fide investment; and, at $2 per thousand feet. we are enabled to pay a dividend on that capital stock which satisfies every stockholder in our company. Not one has expressed dissatisfaction, and we are enabled to do this because we have not an inflated capital. We are not afraid of opposition. I do not believe that the trouble is all with the municipalities. I think that the gas companies are to blame in many instances for the position which they hold to the municipality. I do not think

the blame is all on one side. I think that the difficulty could, in a great measure, be overcome by the manager of the company. It would not be a bad idea, in my judgment, for the companies to take some little interest themselves in city affairs, so that they can have some voice in the matter of legislation. I found that worked very well in our experience. I have found that it has been of a great deal of benefit to have some one connected with our business as members of the Common Council. It worked so well in our company that I have come to the conclusion that it is a very good plan to have some of the stockholders members of the Common Council or Board of Aldermen. I think it has a healthful influence in the shaping of legislation. Certainly stockholders of the gas companies are competent to participate in the administration of city affairs. They are, as a rule, practical men, and are certainly as competent as stockholders of gas companies as those who are not stockholders, and they will not be likely to legislate to their own injury, to say the least. I do not believe in seeking for too much legislation. I think we have some companies that suffer from over-legislation. The less of that we have, the better we are off, in my opinion. I, for one, do not fancy having a smelling committee to come around every little while and investigate the quality of the gas, and fix the amount that I am to charge for it. I do not want to be interfered with in what I am doing, and I don't think anybody does. I think we should conduct our business in a practical, common-sense way, and so deal with the public that they shall be satisfied that we are not charging an exorbitant price for our gas, and making large profits out of our business.

I do not think that we should withhold too much from the public, nor do I think we should submit our business to the inspection of the public in all its details. I think that we should preserve an attitude of honesty and fairness toward the public, and give them such information in regard to our business as shall satisfy them that we are working honestly and fairly. I think gas companies have not appreciated this position as they should, and that they have occupied the positions I have alluded to toward the public too much for their own good.

I think that the managers of gas companies ought to have influence enough with their board of directors (who are generally not intimately acquainted with the practical details of the manufacture of gas) to be able to fix a price that the public will be satisfied with. For, if the consumption of gas is made popular, the consumption increases; and I think the way to bring that about is to establish a low price for the gas sold—as low as it can profitably be sold, in view of all the circumstances of the business; and I think that then the consumption will increase so that gas managers will be able to pay fair and reasonable dividends, and that the public will be satisfied with what the gas company is doing. I do not think the way to make the consumption of gas popular, and to bring about a proper relation between the gas companies and the public, is to charge a high price for poor management, and interest and dividends on an inflated capital, or anything of that kind. I do not, therefore, think that this Association, or any association, can fix upon a rule of action that will reduce the capital stock of gas companies. The only way that that can be done is by those serving in companies that have an inflated capital, and know it, to satisfy their directors and stockholders that the time has come when they cannot expect large dividends on paper, or what they hold as paper, which does not represent anything that they put into the business. I think that is the great trouble with individual companies as a general thing, and is the very root of this evil of threatened opposition.

MR. NETTLETON—I would like to say a word on this subject. The paper, I think, was on the relation of municipalities to gas companies, but the discussion has wandered from that point to the real gist of the matter, I suppose—namely, self-preservation against competition—which is the real point of interest, so far as this discussion and this question is concerned. Now, how shall a gas manager protect himself against competition? How shall he best do it? In my judgment, a gas manager has got to do that for himself. That, I think, is better than to rely upon legislation, better than to rely upon his directors, better than to rely upon any such influence. Then the question arises: How shall he do it? The answer is: by

qualifying himself to carry on his business, and by so carrying on his business as to be able to make gas cheaper and sell it cheaper than anybody who may come into his district and try to do it. That, in my view of the case, is self-preservation and self-protection, no matter what the capital stock of his company is. If he has a capital twice as large as it ought to be, he cannot pay but four or five per cent on the nominal capital. But, when the competing man comes in, he says: "That manager understands himself; he can make gas as cheap or cheaper than I can, and there is no inducement for me to go there. I must go somewhere else, and find a man who is not so well qualified, and does not understand the business as well as he." With a perfect understanding of his business, I would also include the capacity to be on good terms with his consumers and the community, to be able to satisfy the community that he works for their interest, and gives them the best and cheapest gas he can; and to show them that there is no false representation in quality or quantity, so that if a committee of the Legislature comes to investigate his operations, he can satisfy them that it is right. In my judgment, if the community believe in the integrity of the gas manager, and if he understands his business thoroughly, there is little danger to be apprehended from competition. Self-preservation lies in the hands of the gas manager himself. He must be able to do a little better for the same money, or for a little less money, than any other man. [Applause.]

Mr. Odiorne—I have had some experience lately which just bears out the correctness of some of the statements that have been made here. I am connected with a gas company at Exeter, New Hampshire. We have small works there, and until the present management took hold they had never paid any dividends, and were always at war with the people. The present management has made friends with everybody. The first quarrel we had with the municipality was in reference to the street mains; but we reconciled that so that the people were satisfied and the city authorities were satisfied. Everything seemed to harmonize well. The people of the place and the public officers of the place were on the most excellent terms

with us; but, after we had been running for a while, I was called to Concord to defend the company against the attack of a set of blackmailers who came there to get a charter for an opposition gas company. We only sold two millions of feet, so you can judge what competition there would have been. We paid a four per cent. dividend on that, by struggling and by economy. We have a little set of works, and the capital was watered by the proprietors who originally established the works. They were residents of this city. [Laughter.]

There is one point that I would like to bring up here incidentally, which I think most of the members of the Association must have noticed in their experience. Let a man be never so honest and never so much respected, let him have the entire confidence of the people as a merchant or a business man, yet, the moment he is appointed President of a gas company, they call him a scoundrel. [Laughter.] I have seen it myself and felt it myself. I speak from actual experience, and know whereof I speak. [Laughter.] As I was saying, I went to Concord for the purpose of defending our company against the efforts of an opposition company. I do not know what there was in my face that frightened them; but, after I got there, the opposition disappeared, and in less than twenty-four hours I had the unanimous report of the Senate Committee of our Legislature. And when I came to investigate the matter, I found the opposition was started without any co-operation by the municipality, without any co-operation by the citizens, but that the clerk of our company was the head man of the opposite party. [Applause.]

Mr. McIlhenny—I do not know that I can throw any light upon this subject. It has already been pretty well ventilated. I agree entirely with Mr. Odiorne. It seems to me there never will be any compromise between the buyer and the maker of gas. I do not think that the price has anything to do with it. No matter how cheap you sell gas, or how good an article you make, the community will always suspect you of fraudulent transactions. As to opposition, in my judgment, the prolific cause in this country is the cheapness of oil. These men come along and say they can make gas cheaper, because they have a

new process. We have all heard of the new process. There are millions of them. But the fact that oil is sold cheaply is a good reason for presenting this process to committees of legislative bodies that are ignorant of the subject. These men present elaborate drawings, and make exaggerated statements of the low price at which they can sell gas, and our legislators, supposing that they are honest, feel bound to accept these men as substitutes for the parties who are supplying the community. They say: " These men can sell gas at fifty cents a thousand, and the company that is now supplying the community are selling it for $2." So they think it is their duty to accept the opposition parties. It is not their business, they think, to inquire into the permanency of these proposed companies, the possibility of their being able to make reasonable profits; and they reason that if such opposition parties are willing to take the risk, they are willing to have them do so. I have known of parties in the community in which I live to go to our Legislature, which is Congress, and offer to make gas for $1 a thousand, when the old company was selling gas at $2.25, and when the general price throughout the country was $2.50; and it was only by the greatest effort and influence and persuasion and exertion upon the part of the old company that the scheme was frustrated. In my judgment, no matter what the price of gas is—whether it is $2 or whether it is 50 cents a thousand—you will always be denounced as frauds. Even in Europe, where gas is sold very cheap, I do not think that the circumstances have changed. In one place I visited there on my trip they were selling gas for about 62 cents, and I asked the officer if there was any complaint. The day of my visit happened to be pay-day. He told me to sit down and listen for myself; and I heard precisely the same complaints that I have heard a thousand times here, of high bills and poor gas. And so, Mr. President, it will be as long as you are selling an article without any definite cost, and as long as the consumer does not know what he is going to pay until the end of the month. He is paying for an unknown quantity. He forgets how he is burning gas, and when the bill comes, he is disappointed; and as long as he is disappointed he is going to be discontented, and will grumble. The price, as I have said, has very little to

do with it. I think the experience of everybody is, that, no matter what the cost is, the complaint is about the same. I think that to some extent the dissatisfaction of the community might be overcome, or at least modified, if you could reach every individual consumer and show him that what you are doing is right and fair. If you could reach each consumer and explain to him about the cost of gas, and assure him and satisfy him that you are making only 10 per cent dividend, he would not think that that was too much; but still he would have that feeling of doubt in his mind all the while. He would say: "I cannot but think that what you tell me is true; I cannot help believing that you are not making exorbitant profits out of your business and paying enormous dividends to your stockholders; but, at the same time, there is something about the whole business that is very mysterious. I do not see through it; I do not understand it." The trouble is, he does not want to understand it; for, if he did understand it, he would no longer have any cause of complaint. He wants to have some cause for grumbling. If he is satisfied that you are honest, and that you are doing the fair and honorable thing, there will no longer be any cause of complaint. Consumers want to have this doubt upon their minds, so that they can attack you at any time. They don't know what their bill is going to be, and they are always glad of some reason for attacking you.

Now, Mr. Harbison lives in a community where he can manipulate the town and control the Commom Council. Of course it is a great advantage to live in such a community as that, where the gas company is able to manipulate the Board of Aldermen and control their legislation; but I do not live in that sort of community. [Laughter.] Such a thing would be impossible in Washington. I use my best efforts to satisfy our people, and at the same time endeavor to meet the wants of the stockholders and sell gas as low as it is sold in other cities; but, notwithstanding that, the papers come out every week and say, "Why, gas can be made for 30 cents a thousand!" Somebody told them so, and the people believe it. It is perfectly natural for them to believe it, or at least to say that they

believe it. They accept it as true, because it is to their interest to so accept it. This matter is agitated just as much in London as it is in Washington, although gas is sold there very cheap. The companies have a great deal of trouble there in different ways.

Just as I came in, I heard something in the paper read about inspection laws. I live in the only city in America, probably, where there is an inspection law, and it is perhaps the most rigid inspection law in the world. At first we were very much opposed to it, supposing it would be a great inconvenience and trouble to us; but we became used to it, so far as complying with it was concerned; and, from our experience, I believe that an inspection law has a tendency to compose and satisfy the community, because, if you have complaints about the gas being poor, you can refer them to the inspector. But, then, a difficulty arises even there. The papers will say, "Where is the inspector? What is the matter with him? The gas is miserable!" Although the gas may be really in excess of the law in quality and purity. But, if the newspapers happen to have a poor light in their offices, the gas is blamed for a deficiency in quality; and the people are in the same category, and will say the same thing. They will say, "This inspector is a perfect fraud; he is in league with the gas companies." Therefore I think, that, so far as endeavoring to satisfy the community is concerned, an inspection law amounts to nothing. But I think it is a very good thing for the gas companies, because it compels them to work to a certain standard, and to sell a pure article. In that respect, it is a good thing.

As I said in the beginning, I do not think there will ever be a compromise between the consumer and the seller of gas. In the first place, the people have no faith in the meter. They say that a meter can be manipulated, that it is never correct. And in the next place, as I said before, they never know how much their bill is going to be until they get it. The days may be dark, the weather may be bad, and they may burn more gas in their houses than they think they have. Every man that is circumspect in his expenditures is obliged to consider the amount of his coal bill and his butcher's bill, and regulate his

domestic affairs accordingly. It is not so with the gas bill, and when the bill comes in at the end of the month, and it is more than they supposed it would be, they grumble. For that reason, I say that I do not believe there will ever be a compromise. I admit the force of the argument, that it is the duty of the gas companies to sell gas as low as they possibly can; but I do not believe that the gas companies are any more bound to exhibit to the public a detailed account of their expenses, than are any other manufacturing corporations. No other kind of manufacturing business is called upon for an exhibit of the cost of production or of the amount of their profits, and I cannot see why gas companies should be made an exception to the rule; besides, if the gas companies did make an exhibit of their profits and expenditures to the public, they would not be satisfied. They will say that the cost and the expenditures are a great deal more than they ought to be, and that there is a much too large amount of extraordinary expenditures. Therefore, I think that every gas manager will have to battle on individual grounds, and that they will have to do the best they can for themselves under the peculiar circumstances of each case. There seems to be no kind of device that can be universally adopted to establish satisfactory relations between the gas companies and the public, because the circumstances are different in nearly every place.

Now, so far as stopping legislation is concerned, it is utterly impossible. The parties who seek legislation are opposition companies. They have no interest in the community which they are trying to light with gas, beyond getting all the money they can out of the people; and then, when failure or exposure is imminent, to get out of the way as soon as possible. It makes very little difference to them whether they say they will make gas for 50 cents a thousand. Their object is to get a charter, and, by issuing bonds and stocks, to make something out of it, and leave the poor, deluded stockholders to take care of themselves. I suppose that everybody here knows how that is done; but, if there is any one so verdant at this late day as not to know, I will tell him how it is done. The opposition gas business has been a sort of credit mobilier. Four or five men

join, and say, "We will go to a certain place and get a charter." For instance, I am one of the incorporators. We will get a charter, and we will elect directors out of the incorporators. Sometimes, that is put in the charter. You will contract with me for the works. We issue a large amount of stock, say, a million of dollars. We sell it for, say, $400,000 or $500,000. The party with whom we contract to build the works puts them up at a cost of $150,000 or $200,000—the simple works; the $300,000 difference is then divided amongst the others, so that we may get, say, a clear $50,000 apiece. We have erected the works, and the parties have subscribed for the stock. We then go to the old company and say, "Here are these works; what are you going to do with them?" And the result is, that the two companies generally compromise by dividing the city and town into two parts. Now, the original parties have left the concern, and have nothing to do with it They have pocketed their surplus and have gone away and left the works in the hands of the people that subscribed for the stock, and these subscribers have got to do the best they can with them. That is about the way that opposition works are started. There is no possibility then of stopping them, because it is a principle of human nature that, whenever you have got a good thing, all the rest of the world is trying to get it away from you. If you are making something, somebody else wants to get some of it, and, as long as that feeling exists, you are not going to be free from opposition.

I think, Mr. President, that I have shown pretty conclusively that it does not make any difference whether you sell gas for fifty cents per thousand or two dollars per thousand. You cannot stop opposition in this way, and it cannot be stopped until it becomes so obnoxious to the community that they will stop it themselves. That was the case in London, and it will be the case in this country.

MR. HARBISON—Mr. McIlhenny has just stated that it makes no difference what the price of gas is in regard to threatened opposition. Parties who are at the present time making the most earnest efforts to get into our State in various places, have said to managers of gas companies in Connecticut, that in

any place where gas is sold as low as $2, it was of no use for them to try to do anything in such a place as that; but where they charge more for gas than $2, they considered that was the place for them to try to get into. This assertion was made by those who were trying to establish opposition companies in our State.

MR. COGGSHALL—In the State of Massachusetts, any number of gentlemen with a certain amount of capital, two of them inhabitants of the town or city in which they propose to operate for an opposition company, can form a company; but they must get the consent of the City Council or the Selectmen of the town before they can open the streets to lay pipes. I mention this to illustrate one of the statements that has been made here to-day in regard to making gas popular by selling it at a low price. I believe that the greatest enemy we have to contend with is the low price of oil. Now, I was in the city of Lowell a short time ago, and they were selling gas at $1.80. I did not see but one store in the streets which I traveled that was lighted with oil. That shows to me that there was virtue in selling gas at a low price. [Applause.]

THE PRESIDENT—If Mr. Neal will take the chair for a few moments, I would like to say a few words upon this subject. A great deal has been said upon both sides in regard to this question. There is a great deal of force in the views which Mr. McIlhenny has presented; but I think there is another view of it that is somewhat more favorable. I can readily believe that it is exceedingly difficult to satisfy the people of a large city like Washington, even if you deal fairly by them. But I think that the business can be conducted in such a way that you can satisfy the moral power of the community. The moral power of the community is exercised, not by the masses, but by the leading citizens. If you can satisfy the leading influences in the community—the manufacturers, the merchants, the bankers and the business men, that you are doing what is right by the community, you have gone a long distance towards success. [Cries of "hear! hear!" and applause.]

When I first knew the company with which I am connected, they were selling gas at $3. When I became connected with

the company, about thirteen years ago, it was selling gas for $2.50. After awhile, for a great variety of reasons which I need not now stop to state, we reduced the price to $2. At that time we lighted the city at $1.75; afterwards we lighted it at $1.50, and now we are lighting it at $1.25. When we came down to $2, it was a very common remark among the consumers: "Now we are entirely satisfied that you are doing the fair thing." And it produced a feeling of satisfaction throughout the community which exists to this day. And although, occasionally, a man will come and complain about his gas bill (some men will always complain, as we know, and would, even if gas were sold at fifty cents a thousand), yet we pay no attention to that class of consumers, except to receive their money and give them a receipt, and go on selling them gas in the same way. But the best influences in society in our city are on our side, and are perfectly satisfied.

I think it is a great thing to have the moral support of the community in any business, and that it is especially so—in fact, indispensable—in the gas business.

I read with as much interest as I ever read a novel, the history of the test at Lowell some years ago. That is, in my judgment, one of the most instructive books that has ever been published in regard to the manufacture and sale of gas. Now, I think the very point in that case was this: That the gas company succeeded in proving to the Aldermen, who represent the people, and behind whom the people stand, that they could make ten per cent and no more. The managers of the gas companies were called to the stand and made out their accounts and statements, and presented them for the inspection of the Aldermen; and it was policy for them to do so. They succeeded in showing to the entire satisfaction of the people of that city, represented by their Board of Aldermen, that they could keep the gas at a certain standard and sell it at such a price, and could simply make ten per cent and no more; and, therefore, they had solid ground to stand upon. Almost everybody has sense enough to know that a gas company ought to make ten per cent. It is a risky business; it is liable to be destroyed by the introduction of other agencies.

The business has already been very much injured by the introduction of petroleum, and almost every one is willing to concede that a gas company ought to make ten per cent upon the investment. A millionaire in our town, who has not a dollar investėd in gas stock, told me he thought a gas company ought to make fifteen per cent. He said: "I would not have gas stock, unless it paid fifteen per cent." That was going a little further than I wished him to go, but he stated it voluntarily. As I said before, I do not think that any reasonable man can be found who will say that a gas company ought not to pay as much as ten per cent.

The history of the investigation of the gas company at Lowell proved to the Board of Aldermen of that town that the price at which that company was selling gas, and at the standard for purity and quality which they maintained, they could pay ten per cent and no more. It struck one, on reading that book, that it was the moral standing which they occupied that enabled them to come out so triumphantly from the investigation which was then carried out; and I think that what we want, is to have the moral ground to stand upon which that company had, and to be supported by the better influences of society.

Now, this matter of the establishment of opposition companies is one of those difficult questions to deal with which nobody will understand, unless he looks at it in the light of personal experience. There has been a vast amount of this kind of work done, and Mr. McIlhenny has not told half the story.

Men have gone into communities and have constructed works which cost three times more than they ought to have cost; and they have issued stock or bonds, and have sold them and pocketed the money, and have gone away and left the gas companies with a plant that was not worth the ground on which it stood—miserable, good-for-nothing works. There has been a great deal of mean work done in this way—whether done by Philadelphians or not, I don't know.

Our friend, Mr. Odiorne, who was called a scoundrel, probably meant some of our Philadelphia friends when he alluded to Philadelphians.

Mr. Odiorne—I desire to say, Mr. President, that the Philadelphians who built those works are not now living.

Mr. Price—Such men come into a community and put up works that cost a great deal more than they ought, issue stock and bonds, pocket the proceeds, and go away and leave the worthless plant in the hands of the innocent stockholders. Now, what are those stockholders to do? They know nothing about the gas business. When people demand cheap gas in such a community the stockholders say, "Here is a plant that cost us so much, and in order to pay interest upon the money invested and a dividend upon our stock, we have got to charge a high price for gas." The reason why, in a great many places, gas, although sold at a low price, will not pay anything upon the stock, is because just such a swindle as that to which I have referred lies at the bottom of the whole thing. We have very loose laws all through the United States in regard to the issue of stock. Companies can water their stock almost as they please. I do not say they have done it, although there is no doubt that such has been the case in the history of some gas companies that might be named. We know railroad companies can water their stock, and that manufacturing corporations can water their stock, because there is no restraining influence. We had an exceedingly good law in Ohio in regard to that matter. A company could not increase its stock by watering it, because it was obliged to go through a rigid programme before the company could issue its stock, and the directors had to swear that in issuing shares for increasing the capital stock not one dollar had been issued in the way of credit or in the way of watering it. In other words, they had to swear that the cash which the stock represented had actually been paid in. But that law has been tinkered and substantially done away with. Now, what we want, I think, is, where small or petty gas companies are thus situated, a good local enactment--something like that which they have in England—which would put the small companies upon a safe basis. If there was a law by which the matter might be examined into, and by which it might be decided how much capital such companies ought to have, and if they

were permitted by law to make a certain per cent on that capital, I think it would have a tendency to remedy the difficulty to a great extent. I think there might be an enactment by which these companies could stand justified before the community in charging a fair price for gas. As I said at the outset of my remarks, in my judgment the reason why the Lowell Gas Company vindicated itself so triumphantly, was because it succeeded in proving to the satisfaction of the community that its capital stock was bona fide capital, and represented value, and that all its transactions were fair and legitimate with the public, and that it was not making enormous profits, and was not charging an exhorbitant price for gas sold.

I wish to say a word to my friend Mr. Odiorne, in regard to being called a scoundrel That is meant in a Pickwickian sense. After you have been appointed as president of a gas company, the people in the community in which you live know that you are just as honest as you were before; they will trust you just as implicitly they will make you the executor of their estates, and will place as much confidence in you as they ever did, or as they will in any other man. I have had an opportunity to see how that works practically. We are authorized by law to charge 25 cents a month as rent for the meter when the party does not use 500 feet of gas monthly. If a party uses 6,000 feet of gas a year, he is not charged anything for rent for his meter. We have always been liberal, and if a party showed that he used 500 feet a month on an average, or 6,000 feet a year, we refund him any meter rent charged during the year. A man came into our office not long ago who had used about 5,500 feet, and he wanted to have the meter rent refunded. I happened to come in, and the secretary referred him to me. He said that he did not want to have to pay meter rent, because he had used that much gas, and he wanted me to have it refunded. I said to him that I did not see very well how we could do it. I told him it would break down the rule, and that if we did it in the case of one customer who used 5,500 feet, we would have to do it in the case of another. And if we did it in the case of a man who used 5,500 feet, a man who used 5,200 feet might want the same thing, and the

rule would be gone. He said, "I am charged more for having used about 5,500 feet than the man who uses 6,000 feet." "Very well," I said, "if you choose to use less than 6,000 feet and pay the meter rent, that is your own fault. You could have used 6,000 feet and had the meter rent refunded." The man said, "I don't call it honest to charge me more for using 5,500 feet than you do a man who uses 6,000." The man was a prominent citizen, and a member of the church, and I said to him, "Now, you are casting reflections upon directors who are members of your church." He said, "Oh, I don't mean the directors; I mean the corporation. I am talking about the corporation." You see, gentlemen, this man had not the slightest idea that the directors were not honest; but he was talking about that vague thing that has no soul—the "corporation." That is what people mean when they speak of about the dishonesty of gas companies; and when my friend was called a scoundrel, those who called him so did not mean him personally, but the corporation. [Applause.]

I have found that there is great value in a properly executed inspection law We had for years in our State a law which authorized the appointment of an officer by the Governor, with the consent of the Senate, who was called a "gas inspector." Every meter had to be sent to him to be inspected before it was put in, and he placed his mark upon it and certified that the meter was within three per cent of being correct. The law allowed a latitude of three per cent. I found that the law was a very valuable one. In the first place, meter manufacturers were very careful to sell good meters. They knew that they were to be inspected by one whom they believed to be an honest man. In the next place, if there was any trouble about the meters you could always say, "My dear sir, that meter has been inspected by the State inspector, and his badge is upon it; there is every reason to believe that it is correct."

We had a further provision in the law: that if a party desired it, we would send the meter to be re-examined. If it turned out that it registered too much and ran too fast, we should pay the expenses; if it turned out that it ran too slow,

the party should pay the expenses. If it was found to be right, the party should pay the expenses. Although I have had frequent cases of complaints about the meter, I never found a man who was willing that the meter should be sent. They would say, "Oh, it isn't worth while to take so much trouble. The meter has been inspected by a man who was undoubtedly honest, and understood what he was about." I do not know that a government officer is any more honest than anybody else ; but the name and position often carry weight in the mind of a consumer. I have even offered to send the meter and pay one half the expense ourselves ; but those who made the complaint always said, "Oh, no, it isn't worth while, I have no doubt it is all right." The truth is that if you have a standard to go by, and to refer your customers to, it is of great value, and I think if all our states had a good inspection law it would go a good way towards satisfying the community as well as being of practical advantage to the gas companies. But I think what we have to do is to seek, by every means in our power, to place our gas companies on a good moral footing, and to get the moral support and influence of the community, and make gas as cheap as we can and sell it as low as we can, and make a decent dividend. If we do that, I think the community will support us. If we do that, I do not think we shall have very much to fear from the establishment of opposition companies among us, or from the efforts of the blackmailers. I think the remedy for the difficulty may all be summed up by saying that we should aim to make good gas as cheaply as possible, and sell it as low as possible, and gain the moral support of the community—thus having a solid footing upon which to stand. [Applause.]

Mr. C. A. White—If there are no further remarks upon this paper, I move that the thanks of the Association be tendered to Mr. Sherman for his very able and excellent paper.

Adopted.

A paper by Mr. Spencer, on "The Future of the Gas Business," was then read by Major Dresser, as follows :

THE FUTURE OF THE GAS BUSINESS.

Order is said to be the first law of nature, and in all its operations, whether in the growth and development of plants and animals or in the organization of human society, nature's methods are always orderly.

Man, the latest and highest of created beings, endowed with reason and intelligence, seems to have been invested with the ability, and hence the duty, of exploring the vast domain of nature, of organizing, and to a certain extent controlling its forces, and of developing its resources.

The progress of civilization and the advancement of scientific investigation have pretty fully established the fact that in nature there is no loss; that matter, whatever its origin, to whatever conditions it may be subjected, and whatever changes it may undergo, in quantity it remains the same; that certain elementary substances are found to form its constituents, in whatever condition or under whatever circumstances.

This principle in nature, as unfolded in the progress of scientific inquiry, may be, and no doubt is, illustrative to some extent of a similar principle in the world's economy, as applied to the great industrial enterprises that have from time to time engaged the attention and taxed the brain and muscle of mankind in the course of his history.

A very few illustrations, drawn from the comparatively recent history of the race, may be interesting and instructive, as showing that, notwithstanding great changes have been produced and great innovations have been made in the industrial economy of mankind, no great and important industry, having once obtained a firm footing, contributing beneficially to the uses, the comfort and convenience of the public at large, employing a large amount of capital and labor, has ever been entirely superseded and its value lost to the world.

When in England, as far back as 1602, tramways were introduced for carrying coal from the mines, by the use of which it was shown conclusively that one horse could draw the load of two or more by the former method; and later, when Trevetheck, in 1804, using the inventions of Watt and others, by applying steam to what he termed a steam carriage; and later

still, when in 1814, George Stephenson put to practical use the first locomotive, with the startling announcement that in his judgment the time would come when travel by this method would be accomplished safely at the rate of twelve or fifteen miles an hour, a great outcry was raised in opposition.

It was predicted that the innovation would practically abolish the use of horses; that the large amount of capital invested in horses and horse raising would be rendered valueless; and in addition, that the labor market would be greatly disturbed and depressed thereby. But instead, notwithstanding the immense progress in railroad building and operation since Stephenson's day, horses and men have continued to be in increased demand at greatly enhanced prices, and at more remunerative wages.

When in this country a great need was felt for the speedier transmission of the mails, and the administration of Martin Van Buren was trying to solve the problem by experimenting in some of the then Western States, with an express mail at ten miles an hour, the indefatigable and persistent Morse was beseiging Congress for a small appropriation to establish a telegraph line between Washington and Baltimore. He was at first laughed at and denounced as an enthusiast, and an impracticable theorist. But when he demonstrated its utility on a small scale, the note of alarm was again sounded. The destruction of our postal system, with its magnificent appliances was predicted; and worst of all, the hopes of the small army of place holders and place hunters would be buried with it in one common grave.

The telegraph came; its lines increased with wonderful rapidity, and, contrary to the expectations of the alarmists, while telegraph messages multiplied by the thousand, its effect was to stimalate and assist business enterprises in such measure that letters multiplied by the million; so that at present, great railroad coaches groan under the enormous weight of the mails.

When, in the development of agriculture, machinery was about to be introduced, it was confidently predicted that, should its use become general, the products of the farm would be rendered comparatively valueless, and the farmer and farm

laborer would starve together. But, with the development of new and improved machinery and its application to plowing, sowing, reaping, threshing, etc., the products of the farm have steadily increased, their price advanced, and the farm laborer commands thrice as much wages as he did fifty years ago.

The sewing machine, when about to be introduced into our domestic economy, was expected to drive to starvation and desperation the sewing women of the country. But, notwithstanding its rapid strides in public favor, and its immense advantages, the demand for that kind of labor is greater than ever before.

Illustrations in great number in support of this principle might be adduced, but, not wishing to tax your patience unduly, I forbear, contenting myself with one more, and that one from our own peculiar field of industry, with which you are all, no doubt, familiar.

When, in 1792, William Murdock, whose name and memory are cherished specially by every gas man, lighted his house and office in Cornwall, England, with coal gas, using gun barrels screwed together for conducting pipes; and in 1804, lighted the cotton mills at Salford, and the lighting of great thoroughfares and great cities was hinted at, the tallow chandlers and oil producers protested, and were greatly alarmed for the integrity of their business. And, in the face and in spite of the enormous growth of the gas business, and the use of gas by all the civilized world at the present day, the tallow-dip still maintains its importance as one of the many kinds of lights used in some measure, everywhere.

There is, however, another and entirely different aspect of this subject, which it might be useful to consider. All threatened innovations have not by any means been successes. On the contrary, many, very many, inventions and contrivances have been pressed upon the world's attention with great persistency, for which important claims have been put forth and great promises made, which, upon fair trial, have proved magnificent failures.

The "Ericsson Hot Air Engine," which was to entirely supersede steam, was of this class.

The "water gas" abortion, which, with such a flourish of trumpets, such unreasonable pretension, produced so much excitement—in Philadelphia, *notably*—some twenty years ago, and its results, is another illustration.

Nor is the present the only time that electricity, which has been of such incalculable benefit to mankind in its proper sphere (of which more hereafter), has attempted to invade the domain and usurp the place of other and less pretentious elements.

Some ten years ago the writer, being in New York, was startled at the recital, by a very intelligent gentleman—an intimate personal friend—of an account of a wonderful machine invented by one Paine, operated by electricity, capable of being made of any size and power required, of universal application, and operated at a cost of from one-tenth to one-twentieth of that of steam—indeed, the cost was merely nominal.

A small and select number of capitalists, my friend among the number, had already become so fully satisfied of its practicability, and this by witnessing time and again the operation of what the inventor called a "two-horse power" machine, that a company had been formed in New York with a million of dollars capital, a full corps of officers, and a luxuriantly-furnished office on Broadway.

Everything was in prime working order, and the favored few stockholders were anxiously waiting and dreaming of untold millions.

Through the influence of my friend I was permitted, with a select company of scientific gentlemen, to visit Mr. "P.'s" workshop, which was in a dilapidated building in an obscure quarter of Newark, N. J., and thus see for myself the operations of this wonderful invention which was so shortly to revolutionize the industrial economy of the world, and to hear the shrewd explanations of the inventor in reply to questions of the electricians present.

I need not tell you that I was surprised. I stood transfixed with amazement while I saw this little machine, which two men could have carried easily, running a circular saw through a two-inch plank with ease, and operated *ostensibly* and *appa-*

rently by a battery of about four small cups, and, as the inventor claimed, at a cost not to exceed ten cents per day.

My friend promised to keep me posted, and I returned to my Western home. I heard nothing more; and, being in New York again in a year or two, I inquired for this wonderful prodigy; but the place that had known it and its author knew them no more. Nothing was left but an apology. No invention of modern times promised more; none have yielded less.

Other and similar cases in great number might be enumerated, did time and your patience permit, but I leave the remembrance of your experience and observation to supply them.

I come now to the question, "What is to be the future of the gas business?" I think I have shown on general principles (though imperfectly), from the history of this and other industries, that a business once firmly established as the gas business is, and one that has served the uses of mankind in so marked a degree, contributing so largely to facilities for business and pleasure, is in no immediate danger of being superseded.

And, also, that every new and really valuable discovery made and developed so as to command the recognition and confidence of mankind, will be an addition to the general stock, but will not supplant others equally valuable and necessary to the world's comfort and happiness.

In view of the foregoing, I am led to the conclusion that the electric light which so recently, both in this country and in Europe, produced such commotion among the holders of gas stocks, need give us little alarm. And, although I am persuaded that few intelligent men actually engaged in the practical business of making gas were at any time seriously disturbed, it must be admitted that there was with us all a little feeling of uneasiness, not comfortable or desirable to experience.

I presume every intelligent man is prepared to admit the possibility of electricity occupying in the future a certain place, of limited extent, in the general field of artificial illumination, unless, after a fuller investigation of its claims, it is found to be out of its sphere in this field.

The experiments of Sugg and others, now being so vigorously pushed, tending to show the superiority of gas under all conditions, even where the most intense light, concentrated at one point, is desired, will probably lead to its abandonment altogether.

I think the intelligent public, even, have already arrived at the conclusion that it can never be successfully applied generally.

An industry that could not only hold its own, but attract to its use millions of capital, in the face of a flood of illuminants issuing often spontaneously from the earth, and—with the improved facilities for its use—producing so good a light as petroleum, I argue, need not fear the electric or any other light; and the agitation should only stimulate to greater effort in the improvement of our methods, and greater diligence in the development of our proper business.

And, by this means, we may be enabled in a quiet and modest way—the way of all gas men—to give notice "to whom it may concern," that we, as prior occupants of this field, not only do not intend to yield our proud position, but that we are worthy to hold it against all newcomers, from whatever quarter or of whatever kind.

To do this, we must pay strict attention to all the details of our business; make more gas and better gas out of our materials; *stop the leaks* in the retort-house, in the purifying-house, in our street-mains, in our offices.

By the strictest integrity in the conduct of our business, disarm captious criticism, whether arising from ignorance or prejudice, or both; and, in a more marked degree in the future than in the past, furnish to our patrons a better, safer, and all things considered, a cheaper light than can be had elsewhere. To the younger members I would say, qualify yourselves for thorough work, not only practically, as most of us have in some good degree, but scientifically, as some of us have not had opportunity to do. Study to make your already important industry a still greater necessity to society in all its departments; to develop new uses, such as cooking, heating, propelling machinery, and such other as your observation and experi-

ence may suggest, never for once losing sight of the fact that the world moves, and those only will hold their position who move with it.

And, as we all honor the memories of the eminent, enterprising and worthy men who laid the foundations upon which we have, to the best of our ability, assisted in rearing the noble superstructure to its present height, may those who follow us when, with superior intelligence and improved facilities, they are called upon to put the finishing touches on the grand old edifice, not disdain to own that we, too, in our day, assisted in no unworthy degree in the great achievement.

MR. HELME—In regard to the future of our business, I, for one, feel that it is very encouraging in several directions, more especially in one that I will name. I think that, if it is adopted by gas companies, we will all find a great increase in the consumption of gas. I had occasion the other day to go into a place on Chestnut street where they were making gas engines, and I was surprised to see the extent to which that industry has been developed. I had visited the place in the month of February or March, and they were then doing but very little. When I went in the other day, I found their shop filled with machines. They had leased the adjacent building, and they told me that orders were crowding on them beyond their ability to supply. All this change seems to have taken place within the last two or three months. It certainly looks very encouraging for the future of our business. These engines are a success. I do not know whether the gentleman connected with that establishment is here or not; but I have no doubt he would be very glad to show you what they have there. There are several of them in operation. In a surgical institute in this city, one is run from 7 o'clock in the morning until 6 o'clock at night. I went there and looked at it. They never go near it from the time they start it in the morning until they stop it at 12 o'clock, dinner time. After the dinner hour a boy goes down and starts it, and no one goes near it until 6 o'clock, when it is stopped. They have no trouble with it whatever. I sent one down to Atlanta, Ga., and it was put in a printing office there, and the gentleman who purchased it has written

me a very handsome letter in regard to its efficiency. Altogether, I feel that it is going to be the source of a large increase in our business. Taking all these things into consideration, I, for one, feel very much encouraged, notwithstanding the electric light, and notwithstanding petroleum.

A MEMBER—I have understood that gas engines are used in Philadelphia for elevators, and I would like to inquire of Mr. Helme if he knows where one could be seen in operation in that way.

MR. HELME—I am not prepared to say that they are used for elevators. I think there are some used for elevators in warehouses, but I do not believe they have adopted them in the hotels yet. I cannot even say positively that there are any in use for elevators in warehouses. I regret to say that they have not yet contrived to use them for exhausting purposes, for the simple reason that a gas engine has to run at a uniform rate of speed. Now, a steam engine, of course, is capable of being run at different degrees of speed, and that is absolutely necessary in working an exhauster. We all know that when we want to diminish the vacuum, we have to reduce the speed; and when we want to increase the vacuum, we have to increase the speed of the engine. We cannot do that with a gas engine, because they have to be run at one uniform rate of speed—180 revolutions per minute, I believe it is. They fall to 179 revolutions and to 181 ; but 180 is what it is meant to be. Therefore they cannot as yet be successfully used for running exhausters in gas works in this country. But the manufacturers say that there is one in use abroad for that purpose. I can make inquiries as to whether these engines are used for elevators in this city, and will probably be able to give the desired information in the morning. There is one in a jewelry store near by, but it is in the basement, and is not always in use; besides, it would be necessary to pass through the store, and it might be troublesome in getting at it. But this one that I spoke of in use at the surgical institute can be seen at any time.

MR. MUNZINGER—I do not see how it is possible to run gas engines for elevators, because the engines have to be stopped

and started. In a warehouse, where they can shift the belt, it might be very well adapted to that purpose ; but as the engine is at present constructed, I do not see how it could be used for elevators in hotels. Perhaps this difficulty, however, may very soon be remedied.

MR. HELME—It cannot be run for elevator purposes where they have to stop and start the engine, that is, every time. But there are many mechanical contrivances which might be adopted, where the elevator belt can be so adjusted that the engine can be used for that purpose. Some contrivance of that kind, it is possible, may easily be adopted, so that the difficulty may not be a serious one.

MR. C. H. NETTLETON—This subject of gas engines is one in which I take a great deal of interest. I really think more of it to-day than I do of the gas stove business, because I believe we can make more money out of it. I have supplied two engines to manufacturers, one an engine of 7-horse power and one of 4-horse power. The 4-horse power engine has run over a year, and the 7-horse power engine has run a little over a year. I have just sold another 4-horse power engine. The 4-horse power engine has been run intermittently for printing presses and for making paper boxes. It has used a trifle over 50,000 feet during the time it has been in use. The other one has been running sewing machines for making corsets. It is placed in a four story building. That has used on an average 20,000 feet per month. It has gone as low as 18,000 feet and as high as 22,000 feet, but the average has been about 20,000. With gas at $2 per thousand, the parties who use the engines are exceedingly well satisfied. With one engine there has been absolutely no trouble at all. It is used by a concern who know how to take care of an engine, and it has given them no trouble. The other one is used by a concern that do not know much about handling engines. They are men from the ordinary walks of life ! Until within a few years, I believe, they were butchers, so that they knew nothing about machines, and they had some little trouble ; but they now say they have little or none. All the labor that is spent upon this engine (the 7-horse power one) is the time required to start it in the

morning, which takes about five minutes. It runs until noon. At one o'clock it is started again, and it runs until night. Every Saturday the sliding valve is taken out and cleaned, and about once in four weeks the piston is taken out and the gummy substance cleaned off. The labor amounts to almost nothing at all. The people who sell these engines are Messrs. Schleicher, Shumm & Co. They are young German people, and I like them exceedingly. I have found their statement to agree exactly with the results as nearly as I can get at them. They say that is about the average horse power of the engines sold in England, and that out of 21½ feet per hour you can lift 33,000 lbs. one foot high in a minute. We have found that it requires about 33 or 35 feet per hour; but the parties who use the engines are satisfied. The gentleman who uses the 7-horse power engine uses a large amount of gas; but he told me that although he is using so much gas, it costs about the same with labor added; but said he, "I am afraid of a steam boiler. There is danger of the water getting low, and the boiler exploding and the property being destroyed; with this engine there is absolutely no danger."

I suppose it is true that there is no possible danger in using these machines. I believe that there is a great future for them. I believe that in manufacturing operations, where there is less than 10 horse power required, they can be introduced and used profitably with gas at $2 a thousand, and that you can get almost any price for them after they are introduced, because they are so exceedingly handy. I am going to see the people who manufacture them to-morrow morning on business, and I would be very glad to have any gentleman accompany me who wishes to see them. I think he will be repaid for his visit. [Applause].

Mr. Neal.—I would state that in the office of the Boston Gas Light Company there is a gas engine running almost constantly, furnishing power for a printing press, on which all the bills that are used by the company are printed. It works very satisfactorily.

The Secretary—I would like to ask on what floor the 7-horse power engine is used.

Mr. C. H. Nettleton—It is the second floor from the street. The engine is about fifteen feet above the street, and the street is perhaps twenty feet above the gas works. The other engine is at the extreme end of my piping, but we have no trouble. I believe the engine can be supplied on .5 pressure. I generally keep the pressure at about ten-tenths I have no complaints on account of low pressure. There is no difficulty whatever in supplying the engine with gas at low pressure.

The Secretary—Is there any jar to the engine?

Mr. C. H. Nettleton—There is more or less jar on the floor on which the engine is placed. One of the engines is on the second floor in a small wooden building poorly constructed, and when an explosion takes place you can see the floor shake; but there has been no damage, and this engine has been running for a year.

The President—What are the sizes of the engines they make?

Mr. C. H. Nettleton—In this country they make engines of seven-horse power. They calculate to make them twelve-horse power, I believe. In England they have one of thirty, and in Germany one of fifty; and they make intermediate sizes. The smallest size is two-horse power. As I said last year, the great trouble with these engines is the price. I have worked with these men, and tried to get them to reduce the price. They are very frank, and say they cannot afford to. They say that they are obliged by their contract with the patentee to pay 10 per cent; and that they sell the engines in this country at a lower price than they are sold in England. I know that to be the fact. Besides that, the price of labor and of iron is higher here than there, and we cannot reasonably expect them to come down in their price. I get around that by allowing on a four-horse power engine $100 worth of gas free, and on a seven-horse power engine $150 worth of gas free. To parties who put in these engines I allow this amount of gas as a bonus, which reduces the price of the engine very much. I allow the seven-horse power engine $150 worth of

gas free, and in less than a year I have sold over $400 worth of gas for it, which I consider a very good investment.

MR. HELME—In regard to the price of these engines, I will say that I have examined very carefully the work that is done upon them. I have been a machinist myself, and think I am able to judge of the merits of work of this class. There is a great deal of work upon them, and it is necessarily very fine work. Every part of the machinery fits with the most perfect accuracy. The class of work is very fine and beautiful, and very expensive. No better or finer work is ever turned out than they put on these engines, and, as we all know, good work cannot be done as cheaply as poor, slip-shod work. I do not think that the price of the engine is at all high when we come to examine the amount and character of the work that is put upon them.

MR. WOOD (Syracuse).—I would like to inquire of Mr. Helme how the price of the gas engine compares with the price of a steam engine and boiler of the same or larger capacity?

MR. HELME—If you have to buy a Baxter engine and boiler you will not get the same power for the same money. If you go to Providence and buy a Corliss engine of the same power, with a boiler, the whole thing will cost as much money as the gas engine does, and will not do its work any better.

MR. HARBISON—I move that the thanks of the Association be tendered to Mr. Spencer for his very instructive and encouraging paper upon the future of the gas business.

Carried.

MR. NEAL—I am told by the Secretary that there is not sufficient time left to read and take into consideration another paper this evening. As it is quite warm, and the members, I think, are somewhat wearied, I would make the motion that we adjourn until 10 o'clock to-morrow morning. It is not yet six o'clock, the time fixed by the Executive Committee as the hour for adjournment, but I presume, for the reasons I have stated, the members will not be disinclined, in the absence of any important business, to adjourn at this time.

Carried.

THE PRESIDENT—I beg to ask, on behalf of the Association, that every member will be promptly on hand in the morning at 10 o'clock. I hope that those who have outside business to attend to will not unnecessarilv delay it and come in late, and thus interfere with the reading and discussion of the papers. It is rather discouraging to be obliged to urge members to talk upon the interesting questions which some paper that has been read may have raised, and then to have the discussion interrupted by members coming in late while it is going on.

MR. HARBISON—A year ago, when it was proposed that the Association should meet in Philadelphia, there was an impression went out, I do not know from what source, but it was quite general, that Philadelphia, being considered the headquarters for manufacturing articles connected with our business, there might be, during the meeting, many things brought together for exhibition, in the shape of apparatus, burners, etc., which would do away with the necessity of running to this place and that all over the city. I would like to inquire whether anything has been done towards carrying out that suggestion.

MR. CARTWRIGHT—In reply to the inquiry of Mr. Harbison, as one of the local committe of arrangements I would respectfully report that one part of our programme was to carry out, if possible, some such arrangement as that spoken of by Mr. Harbison. Applications by circular were made by the committee pretty generally, to the manufacturers of gas apparatus around the neighborhood of Philadelphia. We received but one or two responses, and they came from outside the city. The manufacturers of apparatus in Philadelphia took the view that it was easier for the members to visit their establishments than to have the various articles brought into one place for exhibition, and that each article could not be sent to such a place without interruption to their business; consequently there was no response made, and the committee had to give it up. I think it was about the 15th of August when the matter was dropped. Another thing in connection with the matter was that it would have necessitated hiring a room at a distance,

or at least separate from this building, which was a serious objection. It would have brought together a great deal of matter, and have taken a great deal of time, and would have distracted the attention of the members from the business of the meeting. Nothing, therefore has been done in that direction, except that Mr. Morris, who is a member of the Franklin Institute, brought some of his apparatus here, and will explain it if necessary. Further than that, however, the committee were unable to get anything together, although we made an effort to do so.

THE PRESIDENT—I had hoped that there would be exhibited some of the new lanterns or burners that we have heard of. The cut of Sugg's lantern burner has been published in the London *Journal* and, perhaps, in the AMERICAN GAS LIGHT JOURNAL, although I do not remember to have seen it.

I was anxious to know, in reading a description of that burner, how it could be supplied with oxygen or air, and, at the same time, avoid gusts of wind. From the published description I could get no idea how the supply of air could be introduced, and, at the same time, avoid the flickering or blowing of the flame by the wind. For that reason I was quite anxious to see the operation of this burner, and had hoped that there might be one on exhibition at this meeting.

MR. HELME—The Wigham burner or lantern is perfectly airtight. The air is all admitted at the top of the lantern, and turns around under the lower edge of the chimney, between the flame and the bottom of the chimney, impinging on the flame as it makes the turn.

THE PRESIDENT—It is very desirable, I think, to introduce these burners into this country for lighting large spaces, parks, squares, halls, etc., and I should like to know the appliances by which they can be made to operate properly.

MR. HELME—I wish the gentlemen of the Association would go and look at this burner on Cherry street that I have spoken of. We have just got it, and it is almost as much of a stranger to us as it is to the gentlemen here. They claim that it is a 51 feet burner; but we have not yet been able to pass more than

35 feet. They say it is 429 candles ; but as we have made no photometric tests we are unable to state its candle-power from our own experiments.

MR. HARBISON—At the Municipal works in New York there is one of these Sugg lanterns in use. It is in their office, and can be seen by any gentleman who goes there.

A single point further. We voted to-day to amend the Constitution by striking out the City of New York as the place to hold the next annual meeting. I would suggest that a committee be appointed to consider the question of location for our next annual meeting, so that the matter will not have to be decided in a hurry.

MR. HELME—I move that the matter be referred to the Executive Committee, and that they be instructed to consider and report.

Carried.

The Association then adjourned until the following morning to meet at 10 o'clock.

SECOND DAY—OCTOBER 16, 1879.

The Association met, pursuant to adjournment, at 10 A. M.

On motion of Mr. Neal, the reading of the minutes of the previous day's meeting was dispensed with.

THE PRESIDENT—The first thing in order will be the report of the Executive Committee.

MR. DENNISTON—I would state, in behalf of the Executive Committee, that heretofore it has been customary for the Executive Committee to examine all the papers proposed to be read. In this instance, however, a list of most of the papers proposed to be read has already been published by the Secretary, and therefore they did not come before the Committee. The Committee have but one recommendation to make, and that is in regard to the place of the next annual meeting. The Committee have recommended that the next annual meeting of the Association be held in the city of Chicago. There is

nothing further for the Committee to act upon, except a recommendation which will probably be made in regard to honorary members.

THE PRESIDENT—The question is upon the recommendation of the Executive Committee in reference to the place for holding the next annual meeting.

The recommendation was adopted.

THE PRESIDENT—I am heartily glad that we have decided to go to Chicago to meet our friends at the West.

THE SECRETARY—The Executive Committee had before them the long and honorable services of General Charles Roome, and his relation to this Association, as well as his long connection with the gas business. As he has now retired from the office of President, they propose to this Association the name of General Charles Roome as an honorary member. The whole matter was fully discussed in committee, and this recommendation is the result of their deliberation.

THE PRESIDENT—Gentlemen of the Association will understand that there was not the slightest desire to retire General Roome. I am sure I but echo the sentiments of every gentleman present when I say that it was our earnest wish to retain his services, if possible, for a longer period; but he is now somewhat advanced in life, and has been for a long time under the strain of the work he has been engaged in. It is not the slightest disrespect to say of him, that he begins to feel somewhat older than he once did, and wishes to withdraw from active service in this Association. He has expressed a strong desire to withdraw from the office of President, and it seems to me but a fitting tribute to the long and eminent services he has rendered, to confer upon him the title of honorary member. It is not understood, of course, that the conferring of such an honor, as it is intended to be, upon him, retires him from being an active member; but it adds to the dignity and importance of the position which he has so long occupied toward the Association When this title is conferred, he will be both an active and honorary member.

MR. NEAL—The unanimous opinion of the Executive Com-

mittee was, that an honorary member could not vote. Of course, he can take part in the discussions. Another point is, that he is relieved from the payment of the annual assessments. Of course, an honorary member is not supposed to be called upon to pay annual dues. The conferring of the title is complimentary. If he is an active member, of course he has both the right to vote and take part in the discussions, and he is also called upon to pay his annual dues. But, in this case, if he is an honorary member, I think he is also entitled to vote and take part in the proceedings of the meeting, the same as if he were an active member, although he is not called upon to pay annual dues.

On motion, the Secretary was authorized to cast the ballot of the Association for the election of General Roome as an honorary member. Major Dresser was appointed teller, and announced the unanimous election of General Roome as an honorary member of the Association.

THE PRESIDENT—I think it would be proper to authorize or request the Secretary, or some other officer of the Association, to notify General Roome of his election.

MR. NEAL—That is the duty of the Secretary, without notice.

THE PRESIDENT—Perhaps it would make the matter more emphatic if the Secretary were directed by the Association in this instance to notify General Roome of his election as an honorary member of this Association.

MR. NEAL—Then. I move that the Secretary be authorized to send a notification to General Roome of his election as an honorary member of this Association.

Carried.

THE SECRETARY—I have an application for active membership which I wish to present. It is the name of George G. Ramsdell, superintendent of the Citizens' Gas Light Company of Vincennes, Ind.; introduced by Mr. W. H. White and Mr. M. N. Diall.

MR. NEAL—The Executive Committee have been consulted in regard to this matter somewhat informally, and they recom-

mend the election of Mr. Ramsdell as an active member of this Association.

On motion, the Secretary was authorized to cast a ballot in behalf of the Association. for the election of Mr. Ramsdell.

Mr. Ramsdell was declared to be unanimously elected as an active member of the Association.

MR. DENNISTON—It has been suggested that the Executive Committee should call attention to the fact, that at the last annual meeting a recommendation was made that the surplus funds in the treasury after each annual session should be safely invested by the Treasurer, with the approval of the Finance Committee. As there was some considerable amount of money expected to be held by the Treasurer at the last meeting, this resolution was passed, after considerable discussion, in an amended form. After the cost of printing had been deducted, however, there will be in the hands of the Treasurer a considerable sum of money; and I desire to call the attention of the Association to the fact that there was such a resolution introduced, and that it was finally adopted in the form as shown upon page 152, vol. 3 of the printed proceedings.

The President, in winding up the discussion, said: "The question now recurs upon the original recommendation of the Committee, that the surplus funds be safely invested by the Treasurer, with the approval of the Finance Committee."

This was carried.

THE PRESIDENT—It will now be necessary for the President or Secretary to notify the Finance Committee of this action, so that the matter may be attended to at the close of this meeting, in order that the funds now in the hands of the Treasurer may be invested as the Finance Committee may direct. I will say that this matter was talked over in the Committee this morning, and several suggestions were made as to investing the surplus funds in bonds, etc.; and it was finally determined to leave the matter as it is, and call the attention of the Association to it, so that, if it is thought necessary, there may be further action taken in the matter.

MR. HELME—As I understand it, there was some $1,200

expected to be held over in the hands of the Secretary and Treasurer at the time that resolution was passed, but, after the printing was done, which amounted to something over $700, there was but a small amount left. After the bills for printing and the miscellaneous expenses were taken out, there was such a small surplus, as I understand it, remaining in the hands of the Secretary and Treasurer, that no investment was considered necessary; but the balance was carried over until this year, when it will be invested in the manner that may be finally determined upon. I make this statement as simply explanatory to the Association of the reason why there was no investment made last year, according to the resolution; but the money will be invested after this meeting, under the supervision of the Finance Committee and the Treasurer.

MR. HARBISON—As the Chairman of the Finance Committee is not present, and being the second member, perhaps it would be well for me to explain to the Association why the Finance Committee did not carry out the instructions embodied in the resolution passed last year. The matter was discussed by the members of the Committee, the Treasurer being absent at the time, and all the members of the Finance Committee being present; and it was there unanimously voted that the surplus funds, amounting to some $600 after the estimated bills for printing were deducted, be invested in government bonds drawing 4 or 4½ per cent interest, and that the chairman of the Finance Committee, with the Treasurer, be directed to purchase these bonds and hire a box in a safe deposit company's vault in New York City, in which to place them in the name of the Association. The bonds were not to be withdrawn from their place of deposit without the presence of the Treasurer and a member of the Finance Committee. At least two persons were directed to be present in order to withdraw the bonds from the place of deposit. The Finance Committee adjourned, expecting that that action would be carried into effect by the Treasurer and the Chairman of the Finance Committee. It was found afterward that when the books ordered by the Association were published, there would not be much money left to invest; therefore, the resolution of the

Finance Committee was not carried into effect. Owing to the illness of the Treasurer during the summer, as he has already stated to the Association, the books were not published until this time. They have not yet been paid for. I am speaking now of the close of the fiscal year of the Association—September 30. As was reported, there is about $1,100 in the Treasury. The bill for the publication of this book, amounting to something like $700, must be paid, however, which will leave about $400, as was stated, in addition to the annual dues now coming in, which would leave in the hands of the Treasurer something like $1,000 or $1,200. As there have been no extraordinary expenses this year, there is no reason to suppose that there will not be between $1,000 and $1,100 left over in the hands of the Treasurer, to be invested as was ordered by the Association last year. I have simply made this statement in order to explain to the Association the reason why the directions embodied in the resolution to which reference has been made, as well as the action of the Finance Committee subsequent thereto, were not carried into effect.

MR. C. A. WHITE—I do not think that there is any necessity for action in this matter at all. I think the thing is in as good shape now as it can be. It seems to me that some other form of investment might be found quite as sensible and profitable as investing these surplus funds in government bonds and hiring a box in a safe deposit company, paying more for the rent of that box than the interest on the amount of money invested. I think the matter may be safely left as it is.

THE PRESIDENT—The resolution adopted last year contemplates some permanent arrangement in reference to the care of these funds, under the direction of the Treasurer and Finance Committee.

MR. HARBISON—The resolution did not instruct the Finance Committee to invest the funds in the way I have suggested, and to hire a box in which to deposit the bonds. It was understood by the Committee that a box could be hired for $10 a year in the vaults of a safe deposit company in which to place this little investment. I think the Finance Committee

are abundantly able to direct and decide as to how this money shall be invested. I am merely calling the attention of the Association to what has been done before, and explaining why the resolution has not been carried into effect.

CAPTAIN WHITE—If there is no further business before the Association at the present time, and if I am in order, I would make a motion that a committee be appointed to prepare resolutions expressing the regret of this Association upon the death of members during the past year. The membership of the Association has become so extended that every year brings the sad record of the departure from this life of some of our members; and it is but just to ourselves, that we place upon our minutes some record of our recognition of the merits of these gentlemen during their lives, and our condolence with their families at their death. I therefore move you, sir, that a committee of three be appointed by the Chair to draft resolutions upon this subject.

Carried.

The Chair then appointed Captain White, Major Dresser and Mr. Nettleton as the committee.

THE SECRETARY—I understand Captain White has a paper which he wishes to read before the Association.

CAPTAIN WHITE—Mr. President: You appointed a committee yesterday, consisting of Major Dresser and myself, to telegraph to General Hickenlooper the congratulations of this Association upon his election as Lieutenant-Governor of the State of Ohio. And that committee now desire to report that they did telegraph to General Hickenlooper yesterday morning, and they heard from the General this morning. The committee do not mean to intimate that the General has not been in a condition to reply to the telegram earlier; but it would seem that the joy he felt upon his election has been such that he was not able to reply earlier. Possibly, some of the Gold Seal which he so bountifully opened for us when we were at Cincinnati, has been opened by his friends for his entertainment. The committee telegraphed to him as follows:

"The American Gas Light Association, in session at Phila-

delphia, desires to know if the citizens of Ohio have sufficient confidence in a gas-man to elect him as their Lieutenant-Governor. If so, we congratulate the citizens. Answer, for, 'We in anxious expectation sit.'" Signed by the Committee.

General Hickenlooper replied to this effect:

"Say to the American Gas Light Association, that, among her other memorable acts, Ohio has chosen a gas-man for Lieutenant-Governor, by 17,000 majority.

[Signed] A. HICKENLOOPER."

[Laughter and applause.]

THE PRESIDENT—The reading of papers is now in order. The Secretary suggests that the first paper had better be one prepared by Mr. Charles H. Nettleton.

The paper was then read by Mr. C. H. Nettleton, as follows:

SUPPLYING GAS WITHOUT A HOLDER.

Early in June last, I had the exceptional experience of supplying gas without a holder, and thinking the details of the work might possibly be of some use and interest to the members of this Association, I have jotted down a few notes relating to it, and trust I shall present them in intelligible, if not in elegant, English.

The circumstances and causes which led me to supply gas without a holder were as follows: The company I am connected with has but one holder, of a capacity of 50,000 feet. Owing to the defective fastenings, the larger part of the wall plates against which the bottom rollers ran had fallen to the bottom of the tank, and as that gave the holder a great deal of play, it rose and fell very unevenly. It was invariably at least one foot higher on one side than the other, and sometimes two or three feet. Often the crown pulley got off the guide rails, and occasionally it freed itself entirely, and fell over on its side. I was fearful that any day it might be so disabled that it would be impossible to use it.

This state of affairs had reached such a pass last winter that, although sending out over 40,000 feet, I did not dare raise it

but half way up. As the consumption was rapidly increasing, it was evident that by some means the holder capacity must be enlarged. The directors voted to build a new holder; but that meant a debt, and consequently I disliked exceedingly to adopt that plan. I knew that a city in Massachusetts had been supplied without a holder, and after paying a visit to that place, and interviewing the manager, from whom I received a great deal of encouragement to repair the holder, I resolved to make the experiment of supplying gas without it.

As a preparatory measure, a circular was sent to all the consumers, stating the fact that certain repairs were necessary, and requesting all to use as little gas as possible, and preparing their minds for a possible failure in the supply. It may be interesting to note here that for the eight days the holder was out of use more gas was sent out than either before or after. A portion of the increase was probably due to increase in pressure on the mains; but I doubt that any of the consumers, except personal friends of my own, paid any attention to the request.

The inlet and outlet of the holder were connected by a four-inch pipe, the drips filled, and in that way the gas passed directly from the station meter to the mains.

In the ordinary supply but one bench of five retorts is used. A second was fired up. These were each composed of four retorts, 12 x 22 inches, and one 15 x 30, all 9 feet long—giving in all 177 feet of retort floor.

In order to economize time, it was arranged to pump out the tank in the night. The holder was grounded at ten o'clock, and of course, at the same moment, gas was supplied direct from the retorts. For a short time more gas was sent out than was needed, and in consequence the pressure ran up from 1.6 to 3.0; but by slacking lids this was soon reduced. The next day and during the following days it was quite easy to keep the pressure nearly uniform, by charging retorts often with 50-pound charges. The day man had instructions to watch the pressure gauge carefully, and when the pressure had fallen to 0.9 to put in a charge. This would cause it to run up to 1.4, and then, in about half an hour, the operation would

be repeated. In this way an average of 4,460 feet was sent out each day, between seven o'clock in the morning and six in the evening.

For the night work, the following routine was generally observed, and as it worked well, I give it in full. It was singular to notice that night after night a certain number of retorts were needed by a certain time, the variation being scarcely more than two minutes.

By half-past six all retorts were empty except one, and that contained a fresh charge of 150 pounds, with pressure at 1.4. All lids were ready luted, coal in wagons, and everything in readiness to charge when gas was needed. By seven o'clock the pressure would drop to 1.2, and a charge of 300 pounds was put in. It would then run up to 2.2. By twenty-five minutes past seven it would fall to 1.6, when another retort would be charged, and the pressure would increase to 1.8. After ten minutes the pressure would commence again to drop; and on the slightest indication of this a third retort was charged. From this time on it was generally necessary to charge the remaining retorts as fast as two men could do the work. Once, and once only, the pressure dropped to 1.4, and remained so for an hour; but otherwise it was maintained steadily during the hours of a large consumption at from 1.6 to 1.8. After ten o'clock the pressure would increase so that the lids of one or more retorts were slacked. At twelve some fresh charges were needed; but the consumption was so slight that 100 to 150-pound charges were sufficient, and at daylight this was reduced to 50 pounds. The average daily consumption was 18,100 feet, Sundays excepted.

In only one thing have I any cause for regret. The coal used during the daytime was so slight in quantity, and the heats so high, that the mains became filled with exceedingly poor gas, and this had to be consumed in the early part of the evening, before the fresh and rich gas reached the burners. As all of my time was spent at the works, I did not know how poor it was until one of the consumers spoke to me about it. If that had been avoided, either by the use of cannel or slacking the lids of the retorts before all of the gas had been extracted, the work would have been done to my full satisfaction.

Before starting with this work, it was suggested to me that there would be considerable oscillation in the pressure, caused by the revolutions of the exhauster fans, and that the supply would for that reason be unsatisfactory. Such was not the case, however, as the oscillations in the pressure were generally half a tenth, and never greater than two tenths. It was so slight that I could not detect it in an ordinary burner. From the experience in the city in Massachusetts to which I have referred, and my own, I conclude that for this work one foot of retort floor is needed for every 100 feet consumed in 24 hours.

I trust you will pardon me if I have gone too much into detail. I should not have done so but that I knew of no other way to make a paper on this subject of any value. In it I do not claim any credit for originality, as the same thing has been done at least once before in this country; and, further, I should not have written this paper at all but that I wished to place on record the fact that gas can be supplied without a holder.

THE SECRETARY—Mr. Coggshall, of Fitchburg, Mass., I believe, was the first one who attempted to supply gas direct from the retorts. Mr. Coggshall is present, and perhaps he will give us the result of his experience.

MR. COGGSHALL—My experience was so similar to that detailed by Mr. C. H. Nettleton in his paper that it is hardly necessary for me to go over it. I had substantially the same experience that he had.

MR. FLOYD—I would state that some nine years ago, about Christmas time, I lighted Blackwells Island for a week without any holder.

A MEMBER—I understand that Mr. Cartwright had some experience of that kind some years ago.

MR. WM. CARTWRIGHT—My experience was not exactly furnishing gas without a holder. It was necessary that I should keep up the supply of gas to our customers. I constructed a temporary holder of framework, and floated it in the river. Its capacity was about 6,600 feet. We were then sending out about twenty. I did not send it out entirely without a holder.

The holder was made of 3x4 scantling, and the sides were covered with ordinary inch pine boards, covered with tin to make it tight.

THE PRESIDENT—You did not attempt to supply gas without a holder, but you made a temporary holder.

MR. CARTWRIGHT—Yes ; I constructed a temporary reservoir, and floated it in the river, and by that means I kept the supply going.

MR. HARBISON—I would like to inquire what yield Mr. Nettleton got from his coal at the time he was supplying gas without a holder ; and also whether he found that financially it would be profitable to run gas works without a holder.

MR. NETTLETON—The yield was about four feet. It was not profitable to run without a holder. I would not advise the stockholders of gas companies to run their works without a holder. It was a matter of economy with us ; we could not afford to build another holder, and we got along very successfully—at least I think we did. Of course, during that week my expenses for coal were more than they ordinarily are.

THE PRESIDENT—No one will understand Mr. Nettleton as advocating a system of that kind. He does not recommend the resort generally, and a system of supplying gas without a holder, I apprehend, would not work.

MR. HARBISON—I did not mean to intimate that he did so. But I simply wanted to get his views upon the matter. We had a similar experience to that in our works. About fifteen years ago our holder was not of sufficient capacity to furnish all the gas demanded, and for a time we supplied the gas from the mains. We increased our supply in that way. In addition to the capacity of our holder, we sent out enough from the main to supply the demand.

MR. McILHENNY—Every manager of a gas company should be a man of expedients. Mr. Nettleton shows that he was the man for an emergency of that kind. He adopted his peculiar process in a case of necessity. I can see no difficulty in supplying a small town without a holder, provided your manufacturing capacity is equal to your maximum consumption. If

the manufacturing capacity is less than the maximum consumption, then it would be impossible. It would be impossible to supply a large city without a holder, because you cannot get a supply sufficient to do it properly. I do not think there is much difficulty in a small town, where you can manufacture just such an amount as you require. But where your manufacturing capacity is less than the maximum consumption, it will be impossible.

MR. WM. CARTWRIGHT—I would inquire of Mr. Nettleton if he had very many complaints among his consumers during the time he was furnishing gas in that way?

MR. NETTLETON—Perhaps I did not explain that point to the Association as I should have done. There was a constant variation in the pressure of about one-half a tenth. Sometimes the gauge would jump up to two-tenths; but the average was about one-half a tenth. I had some complaints from my consumers about the quality of the gas, some of them saying that it would scarcely light. This was caused by the mains being filled with poor gas, and when it was first turned on the quality of the gas was certainly anything but good. But, of course, when the fresh gas came along it was of the ordinary quality. This could have been avoided by putting in cannel, or by not getting all the gas out of the coal. If I were to go over the same thing again, I could do better.

MR. NEAL—I confess to a feeling of disappointment since hearing the conclusions arrived at by Mr. Nettleton after trying these experiments. Of course you can easily reduce the cost of manufacture, but it is not so easy to bring down the cost of distribution. When I heard that such a paper was to be read, I had great hopes that Mr. Nettleton was going to bring forward something to show how the cost of distribution could be reduced very materially; but I find that the conclusion he has arrived at is that the cost of distribution cannot be reduced by distributing the gas without a holder.

MR. HARBISON—There was a point drawn out in the paper by Mr. Nettleton, which I think the Association has not noticed. He shows quite clearly how the consumption of gas may be increased. We heard from our President yesterday,

his very interesting remarks about the necessity of having the moral support of the community in favor of the gas companies. I heartily agree with all he said upon that point. Mr. Nettleton had the financial support of his community during the time he was making these experiments; and he points out to us very distinctly the way in which companies may increase their consumption. All they have to do when they are laboring under a difficulty, is to send out circulars to their customers, and to say that there is a possibility of a shortness of supply, and to request them to use as little gas as possible. They will at once light up every additional burner about their premises, in order to help the company out. [Laughter.]

MR. HELME—I am little surprised at the view Mr. Neal has taken of this matter. I thought Mr. Nettleton was simply going to give us a little of his experience, in order to enable us, who sometimes get into tight places about Christmas week, to get out of them; and I think he has done it very clearly. I am sure no gentleman in the Association will understand that he suggests the idea of running gas works without a holder. Any one knows that we make gas during twenty-four hours, to be used up in about four. But, we further know, that at times (especially during Christmas week, and notably in Mr. Forstall's city) there is a very large increase in gas consumption, and it is certainly of great importance that we should know how to get out of the emergency when it presents itself. Mr. Nettleton has shown us how he tided over precisely such an emergency as we are likely to find ourselves in at certain seasons of the year. By adopting a suggestion that he has made, with holders of the capacity of 75,000 or 100,000 feet, we could send out 125,000 or 150,000 feet. In Atlanta, it was done this week. We sent out 91,000 feet out of a capacity of 80,000 feet, and we expect to be called upon to do the same thing again. This paper of Mr. Nettleton's, I regard as one that is exceedingly valuable to the Association, because it points out the way in which it can be done easily, and without giving dissatisfaction to the consumers. I found myself, after the first night or two, in something like the predicament that a gas company in this neighborhood found themselves in. They

had received very nicely built works, but, in the early part of the evening, they found that the gas was very poor; it was a mystery to them, and the contractor could not explain it. But, when somebody went there who knew something about it, they found that they were using the same pipe for an inlet and an outlet. The result was, that, when the consumers turned on the gas, the gas went straight from the meter into the streets, and, at the beginning and end of the charge, they had very poor gas. But that was corrected. Mr. Nettleton, I believe, charged the retorts separately, and kept his eye on the pressure gauge, and conducted his experiments very successfully and satisfactorily. I think this paper is full of valuable suggestions to us, who may find ourselves in an unpleasant position about Christmas week, which is very often the case.

I move that a vote of thanks of the Association be returned to Mr. Nettleton for his very excellent and practical paper (which is generally the character of the papers Mr. Nettleton favors us with) that he has just read.

Mr. Harbison—I wish to say, before the motion is put, that we had no such difficulty as he alludes to in reference to poor gas at the end of the charge. We tried these experiments one after the other; but there was no break in the quality of the gas. We charged, every hour, a quarter of the number of retorts in the house; but we had, during no particular time of the four hours, a poor quality of gas. We did not experience any difficulty of that kind at any time.

Mr. Helme—Mr. Nettleton has stated that he could now easily overcome that difficulty, since the experiments he has tried.

A vote of thanks was then tendered to Mr. Nettleton.

The President—The next paper is that of Mr. Pearson, of Toronto, on the manufacture of gas from water, under the Lowe Process, at Toronto, Canada.

The Secretary—Before Mr. Pearson commences his paper, I wish to say how it come that he presents it to the Association at this time. Early in the summer requests were made to me as Secretary of the Association that the subject of water gas generally might be discussed at this meeting, so that it might

be fully investigated by the Association, in order that the different companies might know the real merits of that process, and how far each company might be effected by it ; whether all would be affected alike, or whether it would be proper for some to adopt the new process and some to adhere to the regular coal process. During the summer several requests came from different members, expressing the same view, and suggesting that the subject be ventilated at this meeting. I then applied to Mr. Pearson for a paper on that subject, as I thought he was favorably situated to give us some results from practical experience. Mr. Pearson at first asked to be excused, but I pressed him most earnestly that he should prepare and read a paper at this meeting, and he has consented to come here and present the paper at a very considerable inconvenience to himself.

MR. PEARSON—I am very much obliged to the Secretary for his kindly introduction. I will state, before reading the paper, that I have been laboring under ill health of late, and have not been able to make my paper as satisfactory in every respect as I could wish it to be.

Mr. Pearson then read his paper on the manufacture of gas from water at Toronto, under the Lowe Process.

THE LOWE (WATER) GAS PROCESS.

At the last meeting of this Association, in reply to some statements made by a member in a paper on water gas, unfavorable to the Lowe Process, I gave an account of what I had seen of its working in several places which I had visited, and expressed my conviction that the chief cause of its failure, where it had failed, was the want of proper purification. I stated, further, that the Consumers' Gas Company of Toronto, of which I am the Secretary, had purchased the patent right for Toronto conditionally, and that the proprietors, S. A. Stevens & Co., were about erecting two sets of apparatus in the works of the Company; and I promised that if I should be present at this meeting I would give an account of its working there.

It is in fulfillment of that promise, and in compliance with the very urgent request of the Secretary of this Association, that I now, with considerable diffidence, present this paper.

As Mr. Chambers, in his paper, gave an account of the origin and progress of water gas in general, I shall confine my remarks entirely to the Lowe process. I would, before proceeding further, state that I am not in charge of the works of the Company; they being under the superintendence of Mr. Alex. Patrick, under whose supervision the works now in progress of erection hereafter referred to are being built. I have had, however, ample opportunity to watch the working of the process in Toronto and elsewhere, and to become acquainted with its details; and can speak with full confidence as to the financial results.

As most of the members of this Association are doubtless aware, the Lowe Gas Process was invented by Mr. T. S. C. Lowe, of Norristown, Pa., and the process was patented by him in the United States in September, 1875. It was first worked by the inventor at Phœnixville, Pa., in 1874, upon a very small scale, where the original works are still in operation, and subsequently works were erected at Conshohocken and Columbia, Pa.; Dobson's mills, Philadelphia; Trenton, N. J.; Harrisburg, Pa.; Fort Plain, Utica, and Clyde, N. Y.; Lancaster, Pa.; Indianapolis, Ind.; Baltimore, Md.; Scranton and Wilkesbarre, Pa.; Newburgh, N. Y.; and Kingston, Brockville and Toronto, Ca.

It will thus be seen that the process has made considerable headway since its introduction at Phœnixville, five years and a half ago, and with the exception of Trenton and Harrisburg, where the gas was not purified, most of the above companies have, in a published statement, expressed high satisfaction with the process.

The Apparatus.

The apparatus consists of oil storing and distributing tanks, a generator, superheater, wash-box, scrubber, condenser, hydraulic main, and multitubular condenser, boiler, and blower. The oil distributing tank is placed above the working gallery, and has tubes at the bottom to convey the oil to the generator.

The "generator" is the chamber in which the gas is made. It is a cupola made of boiler plate, lined with fire blocks. It has an opening at the top with a cover, which is clamped down during the process of "blowing up" and gas making. There is a grate at the bottom, with an open space below, through which it is blown up by the air blast. A pipe is inserted a short distance above this space, through which the steam is forced during the process of gas making. A pipe from near the top of the generator conveys the gas to near the bottom of the superheater.

The "superheater," where the gas is "fixed," is also a boiler plate cupola, lined in the same manner as the generator. It is generally from one-third to one-half higher than the generator, and one-fifth less in diameter. There is an arched air space in the bottom, the arch being perforated. Above this space, and nearly up to the gas outlet at the top, fire brick are placed in layers, with spaces of about two inches between them. It has an opening at the top communicating with the smoke-stack, which is left open during "blowing up," and closed with a valve during gas making. Another pipe from near the top of the superheater conveys the gas to the wash-box, and an air-blast pipe enters the bottom of the superheater near the pipe connecting it with the generator.

The "wash-box" is an oblong boiler-plate box, square on three sides and rounded at the bottom. A perforated boiler-plate diaphragm is placed across about one-half of the box, for the purpose of breaking up and more thoroughly washing the gas.

The wash-box is about three parts filled with water, and the gas from the superheater is conveyed by a pipe which passes through the top at the end nearest the superheater, to a sufficient depth in the water to seal the gas. The tar is run off from the bottom into a well. The gas passes from the top of the wash-box to the bottom of the scrubber.

The "scrubbers," of which there are two for each set, are a little higher than the generator, and about three-fifths of its diameter, and are also made of boiler-plates. They are similar to the ordinary scrubbers of coal gas works, and need no further description.

The gas is passed from the wash-box to the bottom of the first scrubber, from the top of the first through the top of the second; then down through the hydraulic main; from thence to bottom of the multitubular, and from the top of the multitublar to the main leading to the purifiers; from thence to the meter, and thence to the holder.

The "multitubular condenser," also made of boiler plate, is only used when the works consist of two or more sets of apparatus, and is generally placed in the centre of the scrubbers. Being similar to those used in coal gas works, it need not be described.

Mode of Working the Process.

The valve from the superheater to the smoke-stack being open, and its gas outlet being closed, the generator is kindled through the door at its base, charged with anthracite, of large egg size, through the top, and then closed and fired up by an air-blast entering below the grate. The gases formed by combustion in the generator, viz., nitrogen and carbonic acid, are driven out of it through the pipe to the chamber at the base of the superheater, where, meeting an air-blast, they ignite and flame up through the loose mass of fire brick, evolving so intense a heat that, by the time the coal reaches a cherry red, this will stand at a white heat. This is the proper condition for gas-making.

The air-blast is then shut off, the valve at the top of the superheater is closed, and at the same time steam (perfectly superheated) is admitted a little below the grate bars of the generator, and, by contact with the incandescent fuel, is decomposed, forming hydrogen and carbonic oxide.

Simultaneously small streams of crude petroleum are dropped through the ascending gases, directly upon the red-hot coal. The hydrocarbons thus released pass, together with the water gas, to the bottom of the superheater, rushing upward among the white-hot bricks therein to the outlet, by means of which they escape to the washer.

Of course, the continuous passage of steam through the coal gradually reduces its heat, and when this falls below a certain

point the gas making is stopped, a small quantity of coal is thrown into the generator, and the blast is applied again until the heat is sufficiently restored.

When the amount of gas required is considerable, two or more sets of apparatus are employed and used alternately—that is, one is running gas, while the other apparatus is re-firing, thus securing a continuous production of gas.

It will thus be seen that the distinctive feature of the Lowe process is the introduction of petroleum or other hydrocarbons to the incandescent coal in the production of the divers gases simultaneously in the same chamber, and this is claimed to be one of its chief advantages, inasmuch as it prevents that waste of heat which takes place when it is applied externally, as in other gas processes.

Introduction of the Process at Toronto.

As I gave an account of the introduction of the process at Toronto at the last meeting of this Association, it will not be necessary for me to go over the same ground again. Two sets of apparatus, of sufficient capacity to produce 150,000 cubic feet per diem, were at that time in process of construction for the proprietors of the patent by Messrs. Ridout, Aird & Co. They were not completed, however, until February last.

Gas was first made on February 9, and on March 1 the works went into full operation; and, up to September 30 last, 26,641,000 cubic feet of gas had been produced.

Results Obtained.

In the following table, I have not considered it necessary to give the prices of materials and expense of labor, as these vary in different places, and it could be of no practical benefit. Each one can make up the cost for himself, at the prices prevailing at the place where his works are located:

Average Results for Seven Months.

YEAR 1879	Average Production per Diem, when Works were Running Full Time.	Average Number of Charges per Diem.	Average Production per Charge.	Average materials used per M feet, whole time working.			Gas Purified Per Bushel Lime.	Number Men Employed in 24 Hours.
				Crude Petroleum	Athracite Coal in Generator.	Coke for Boiler.		
	Cubic Ft.		Cubic Ft.	Gallons.	Pounds.	Bush.	Cubic Ft.	
March	153,000	38	4037	4.46	54.91	.18	16,610	‡7
April	166,000	41	4066	4.11	53.17	.11	8,910	7
May	155,000	39	3604	4.18	52.48	.18	11,630	7
*June	129,000	34	3794	4.09	62.46	.22	11,050	7
*July	107,000	33	3242	4.14	68.91	†.36	9,700	7
August	162,000	35	4674	4.08	58.91	.38	13,960	7
September	163,000	36	4527	4.04	59.09	.38	13,160	7
Average for seven months	148,000	36.56	3992	4.15	58.56	.26	10,717	7

On eleven occasions 190,000 feet and upward per day were made, and on one occasion 210,000 feet.

*During these months a number of samples of coal were tested, some of which were very inferior. There was also a partial stoppage in the supply through the fusion of the bricks and deposition of carbon immediately over the arches in the superheaters.

†Discontinued burning tar after four months.

‡Comprising 1 engineer, 1 oil-man for gallery, 1 stoker for ground floor, and 1 laborer in the daytime. The same force at night, with the exception of the laborer.

Until February, all the gas made was from coal, about 8 per cent of cannel being used. In February, only about 6 per cent of Lowe gas was made. After April 4, no cannel was used except on Sundays, when no Lowe gas was made. After February, the following quantities were made:

March,	Lowe gas, 3,837 M;	coal gas, 8,250 M;	total gas made,	12,087 M
April,	" 4,493 M;	" 5,367 M;	" "	9,860 M
May,	" 4,188 M;	" 4,076 M;	" "	8,264 M
June,	" 3,096 M;	" 3,809 M;	" "	6,905 M

It will thus be seen* that, in the months during which the largest proportion of Lowe gas was made, the quantity of sulphur found was very much less than average, the ammonia considerably less, and that no sulphuretted hydrogen was detected; while the average illuminating power during the time when Lowe gas was made, when no cannel was used, was equal to that of the coal gas enriched by cannel. As the average candle power from April to June was 15.15 (the candle power of the coal gas, without cannel, being under 14 candles), and as less than half of the gas made was Lowe gas, it is fair to assume that the illuminating power of the Lowe gas over 16 candles. Tests of this gas, taken separately by a Sugg's illuminating power meter, showed between 16 and 17 candles, and daily tests taken by the same apparatus, of the mixed gases, averaged from 15½ to 16 candles. It has also been demonstrated that the illuminating power of the gas can be kept at nearly the same figure. The photometer used by the Government is a Bunsen's bar photometer.

General Remarks.

No difficulty of any importance was experienced until the works had been in operation over three months, when a gradually diminishing yield gave warning that something was wrong, and a careful examination resulted in the discovery that the loose bricks in the superheaters, immediately over the arch, had fused together to such an extent as to stop the free flow of the gas. Two or three days, however, were sufficient to remove and replace them, and one day would have been enough, were it not necessary to wait until the superheaters cooled.

**Return of the Illuminating Power and Purity of the Gas of Toronto for the Year ending June 30, 1879.*
Made by the Government Inspector.

1878-79.	Illuminating Power.					Sulphur per 100 Cubic Feet.					Ammonia per 100 Cubic Feet					Sulphuretted Hydrogen—Times Present.
	Highest Candles.	Lowest Candles.	Average Candles.	Standard Candles.	Number Tests.	Highest Grains.	Lowest Grains.	Average Grains.	Standard Grains.	Number Tests.	Highest Grains.	Lowest Grains.	Average Grains.	Standard Grains.	Number Tests.	
July	15.70	15.63	15.67	12	3	14.27	10.10	11.51	20	3	5.25	2.10	3.86	2	3	0
August	16.45	14.70	15.51	12	5	17.55	15.12	16.57	20	5	3.67	2.09	3.20	2	5	0
September	16.01	14.50	15.26	12	4	15.17	11.90	13.72	20	4	3.12	2.04	2.69	2	4	0
October	15.69	14.64	14.97	12	5	15.91	11.82	13.84	20	3	4.00	1.50	2.85	2	3	0
November	15.95	14.23	15.38	12	4	20.30	9.80	14.08	20	5	17.80	6.60	10.30	2	5	3
December	16.33	15.50	15.75	12	4	15.90	11.90	13.37	20	4	5.00	2.50	4.02	2	4	2
January	15.82	14.29	14.96	12	4	11.80	8.10	10.20	20	4	2.00	1.41	1.61	2	4	3
February	15.63	13.49	14.49	12	4	12.40	8.30	10.50	20	4	0.75	0.50	0.56	2	4	1
March	16.46	14.22	15.45	12	8	14.00	9.98	12.08	20	4	1.50	0.75	1.18	2	4	3
April	16.70	14.00	15.42	12	9	9.22	6.70	7.86	20	4	2.00	1.00	1.50	2	4	0
May	15.55	14.62	14.91	12	4	9.56	8.83	9.22	20	4	2.00	1.00	1.60	2	4	0
June	15.88	14.23	15.13	12	4	11.00	9.27	9.79	20	4	3.00	0.53	1.38	2	4	0

The above returns were kindly furnished by the Acting Commissioners of Inland Revenue in advance.

As the quantity of bricks destroyed was only about 200, the expenditure was not great.

This difficulty was unexpected, as we had not then heard of its having taken place elsewhere; but we have learned since that similar trouble has arisen in other works, and we think it will be necessary to have the superheaters examined every three or four months.

In our opinion, a larger amount of purification is required than for coal gas; the cost per thousand, including labor, with lime at 22 cents per bushel, amounts to about 3⅓ cents per thousand; and, owing to the great rapidity with which gas is made, larger purifiers are required than would be needed in coal gas works, where the same quantity of gas is produced per diem. It has also been found necessary to use lime exclusively for purification.

Men of greater intelligence are needed than answer for stokers in coal gas works—more care, watchfulness and judgment being required.

Owing to the character of the petroleum used, it is found necessary to steam out the wash-boxes for about half an hour each day; but, as this is done while the fires are being raked down, no time is lost. Where naphtha is used, it is not necessary to do this. It is also desirable to steam out the scrubbers two or three times a week for a few minutes.

We have had but one stoppage in the pipes in the works after purification of the gas, and that was in the pipe between the purifiers and the station meter, which was partially clogged with naphthaline, but not to a greater extent than has been the case with our coal gas.

There have been no stoppages in the mains outside of the works. A few service pipes have been partially obstructed with naphthaline, but not more than in former years. We have had no complaints of the stoppages of burners.

A large quantity of tar is made, and we are now having an analysis made for the purpose of ascertaining its value.

The advantages of the process, as compared with coal gas manufacture, may be summed up as follows:

1. The great saving in the cost of labor. In works where two sets of apparatus are used, seven men can produce an average of 150,000 feet per diem, and in large works the same number of men can work three sets, and produce 225,000 feet per diem. In Baltimore, they claim that twelve men can work eight sets—that is, six men in the day and six in the night.

2. The small amount of wear and tear, as compared with the retort system.

3. The comparatively small amount of storage room required, where all the coal needed for the year has to be laid in in the summer. One ton of coal being sufficient to make 34,000 feet of gas, not much more than one-quarter of the room is needed.

4. The saving in interest, in not having to purchase so much material in advance, the petroleum being obtainable as wanted.

5. The rapidity with which gas can be made in cases of emergency. In Toronto, as stated, 200,000 feet per diem were made, and in Baltimore I am informed that 600,000 feet have been made with eight sets of apparatus during the night.

6. The heats can be let down at any time without injury to the apparatus; consequently work can be stopped on Sundays. Gas can be made within four hours from the time the fires are lighted in the generators, and it has been done in two hours at our works.

The directors of the company were so well satisfied with the general working of the process and the results obtained that in July last they completed the purchase of the patent right for Toronto, paid the proprietors for the works they had erected and took them off their hands, and decided upon erecting five additional sets of apparatus, another purifying house, additional purifiers and a station meter. The work is now far advanced, and the whole is expected to be completed before the close of the year. These apparatus, with the others erected, will have, together, a capacity of over 500,000 cubic feet per diem.

Situated as we are in Toronto, with anthracite coal a little cheaper than bituminous, and petroleum at a moderate price, we find it considerably to our advantage financially to make

gas by the Lowe Process—so much so that we felt justified in reducing the net price of our gas on the 1st inst. from $2 and $1.75 to $1.75 and $1.50 per thousand feet; and unless anthracite and petroleum advance and bituminous coal declines very considerably, we shall make by far the largest proportion of our gas by the new method; and probably should make the whole, were it not that the works now nearly completed will not be of sufficient capacity to supply the rapidly increasing demand.

The reading of the paper was greeted with applause.

MR. HELME—Mr. Pearson, at our last meeting, made a promise to make a report on that subject, and I rise to say that the paper he has prepared is very full and very satisfactory, and one of the most complete that has ever been before this Association. The subject has frequently come up; but it has always been disposed of in an unsatisfactory way. There is only one thing which Mr. Pearson has omitted, and I suppose that that is the fault of the government inspector; and that is that he does not say anything about carbonic oxide. That has often been a mooted question in connection with the Lowe process of making gas; and I should have been glad if Mr. Pearson had gone further and given us some information upon that point.

MR. PEARSON—I can furnish it if required.

THE SECRETARY—Before the discussion begins I desire to say that it was understood that probably this paper would be very much criticised, and a great many questions asked. Mr. Pearson is ready to answer any questions that may be asked so far as he can possibly do.

MAJOR DRESSER—In order to keep our record straight (which is of great importance) I would suggest that Mr. Pearson be requested to take a seat at the table here, and that each member who has anything to say upon the matter get up and say it and then sit down, and then the next man, and so on. Mr. Pearson can make his notes as to each man's objections; and then, after all the members get through, Mr. Pearson can in one address reply to each one *seriatim*.

THE SECRETARY—As Major Dresser says, it is important to the Association to have this record perfectly clear, and perfectly distinct and accurate. In order to do that we want the name of each man who addresses the President, so that the stenographer can take it down.

MR. LITTLEHALES—I think the most satisfactory method to pursue is for each member to ask Mr. Pearson questions, and to have each question disposed of as we go along.

MR. HELME—I would like to ask Mr. Pearson if he has a record of the exact quantity of carbonic oxide which he gets per thousand feet of gas ?

MR. PEARSON—No, sir. I would say that we have not had the gas analyzed; but before introducing it, the gas, as made at Kingston and Brockville, was analyzed by Professor Allen, of the Toronto University; and if you desire to have that statement I can let you have it. I would say upon that point that I received a letter from a hotel keeper in regard to a lady who had inhaled the gas, which I will read if you wish me to.

THE PRESIDENT—I don't think we want any such trash as that.

SEVERAL MEMBERS—I would like to hear the letter read.

THE PRESIDENT—What we want are facts; what we want is definite information. I am a little sorry that there has been so much hearsay in Mr. Pearson's article. What we wanted most of all was Mr. Pearson's personal experience—that to which he can testify and that which he knows.

MR. PEARSON—With all due deference to the Chair, I must state that I think it is my personal experience. I am personally cognizant of nearly all that I stated to this meeting.

THE PRESIDENT—You not merely read but quoted largely from what you had been told in Baltimore. The article has the general appearance of an advocate's document. We don't want advocate's documents; we want facts. If we can learn facts from Baltimore, we want them ; but what we want to get at is Mr. Pearson's experience and observation. That I take to be the wish of the Association.

MR. PEARSON.—Excuse me, Mr. President; I thought that I had given my personal experience and personal observation in the paper that I have presented. That is certainly what I intended, and what I believe I did. It was simply a statement of what I knew of my own knowledge, and it was so understood by me; and I supposed it was so understood by the Association. I supposed that I was giving my personal experience and observation without being an advocate of the Lowe Process.

MR. LITTLEHALES—I would like to ask Mr. Pearson whether he measured the gases separately or mixed them?

MR. PEARSON—We measured them separately.

MR LITTLEHALES—Can you give us an idea of the difference in the cost between the two gasses?

MR. PEARSON—I said in my paper about 15 cents per thousand feet.

MR. LITTLEHALES—Do you mean after allowing the interest you would have to pay on the patent purchased and on the plant?

MR. PEARSON—I said about 15 cents per thousand feet in the cost of making the gas. I leave the cost of the plant out of the question.

MR. LITTLEHALES—Of course that would make a considerable difference if you added the interest upon the cost of your plant, patent rights, etc., the result you arrived at might differ from that you have stated. What I wanted to get at is what the commercial advantage to your company is over coal gas?

MR. PEARSON—There is very considerable saving in the matter of coal. If we had not used this process we should have had to erect more coal sheds, and have purchased additional property; and we have made a saving of interest in that respect in favor of the Lowe Process.

MR. LITTLEHALES—I submit that that is scarcely an answer to my question. What I want to get at is, adding the amount per thousand feet of the cost of patent rights and of the cost of the plant, add the interest on that, say, at 8 per cent, or any other sum, and then taking the reduced cost, as you have

stated, what is the commercial advantage to your company in making gas by the Lowe Process over the coal process?

MR. PEARSON—I have answered that question in one way; but I can probably answer it as you desire in a moment if you will give me time. I can probably make up the figures so as to give you an intelligible answer. I can hardly state that now, for the reason that, not having experience in the works which we are now erecting, I can't give the answer to Mr. Littlehales' question at once, off-hand.

MR. LITTLEHALES—It is the most important consideration to us in the whole thing.

MR. PEARSON—I cannot now give you an intelligible answer to the question. I ask the Association to bear in mind that we only commenced the use of this process last spring, and that we are running the two processes together side by side. We are now erecting larger works; and, after a year's experience in the manufacture of gas entirely by the Lowe Process, I shall be able to give you more satisfactory data next year than I can at present.

MR. DENNISTON—In continuation of Mr. Littlehale's question, I would like to ask Mr. Pearson if he puts the expense of purification into his estimate?

MR. PEARSON—I do.

MR. DENNISTON—In speaking of the results, you say that it has cost so much for having a certain number of men to produce the gas, but you did not state that there were four or five men employed in purifying the gas.

MR. PEARSON—Not in our works. I alluded to Baltimore. I said it cost about 3½ cents per thousand feet to purify the gas, including labor. When I speak of a saving of 14 or 15 cents in making gas under the Lowe process, I include all expenses—the cost of putting in the holder, including purification.

MR. LITTLEHALES—You mean the cost of materials and labor only. When you speak of the whole expense, do I understand you to refer to materials and labor, or the cost of the plant and the cost of the patent rights?

MR. PEARSON—I said materials and labor only.

MR. M. S. GREENOUGH—I would like to ask Mr. Pearson if he ascertained the amount of carbonic oxide in his gas?

MR. PEARSON—Not in our gas. The Kingston gas was tested before we introduced it in our works. We did not have our gas analyzed.

MR. A. L. ALLEN—I suppose the question under discussion is the subject of water gas?

THE PRESIDENT—No, sir; the immediate subject under discussion is Mr. Pearson's experience in Toronto in the use of the Lowe Process. It is not in order to speak on the general question of water gas. After we get through the discussion of this matter, other remarks upon the general subject may be in order, if the members of the Association desire to hear them.

MR. LITTLEHALES—I would like to ask Mr. Pearson, when he speaks of the comparative cost of the gas made by the Lowe Process, and that made exclusively from coal, how much he made from his coal under the coal process, how much he made per retort and per man? These are important points bearing upon the comparative cost.

MR. PEARSON—I will answer one question at a time. We make about 9,400 or 9,600 feet per ton of coal of 2,000 pounds. We make about 34,000 or 35,000 feet per bench of sixes per diem, two men being required.

MR. LITTLEHALES—What size retorts?

MR. PEARSON—They are nine feet long, and $21'' \times 14''$.

MR. LITTLEHALES—Do you have two men to a bench of sixes?

MR. PEARSON—Yes; one for the day and one for the night.

MR. LITTLEHALES—Then, I understand you to say that you get from you coal, per man, about 18,000 feet per diem?

MR. PEARSON—Yes; about 18,000 feet per diem.

MR. LITTLEHALES—And about 9 600 feet per ton?

MR. PEARSON—Those are the outside figures. I said, from 9,400 to 9,600.

MR. LITTLEHALES—You compare the cost of oil gas, of course, with the results at your works?

MR. PEARSON—We do.

MR. GEROULD—What kind of coal do you use?

MR. PEARSON—Youghiogheny coal, and coal that comes from Brockville and Reynoldsville; but principally Youghiogheny.

MR. GEROULD—You make from 9,400 to 9,600 feet of gas, per short ton, of 16-candle power?

MR. PEARSON—Yes.

MR. McILHENNY—I would like to ask Mr. Pearson whether, in the test that was made by the Government Inspector, he used the new London Argand burner, or the old fifteen-hole Argand? What instrument was used in making the test?

MR. PEARSON—I cannot answer that question. I think it was the old burner.

MR. McILHENNY—I thought you mentioned having tested it with the Sugg burner?

MR. PEARSON—I tested it myself frequently with Sugg's illuminating power meter, which I compared with the Government photometer. The result was, between 15 and 16 candles.

MR. McILHENNY—I will state, for the information of the Association, that in the Government Inspector's office in Washington, we find that the 15-hole Argand burner, established by law for testing gas made in Washington, makes the gas 1.65 candles less than the new burner used now, or the Sugg meter—so, that, gas tested by the new burner would be 1.65 candles better than when tested by the old burner.

MR. PEARSON—Both gases were tested by the same burner.

MR. McILHENNY—If I understand Mr. Pearson correctly, the gas in Toronto would be a little over 14 candles by the test used in Washington.

MR. M. S. GREENOUGH—I do not wish to ask any question of Mr. Pearson which would seem to be inquiring into the private business of his company; but, as bearing upon the question of comparative cost of the two gases, and the comparative cost of materials, according to the location of different

cities, I would like to ask him, what is the market rate for Youghiogheny coal, and the market rate of petroleum oil, in his town?

Mr. Pearson—As my answer to that question would probably be published in the *American Gas Light Journal*, and so might reach the Toronto papers, I would prefer not answering that question publicly. I will tell Mr. Greenough privately with great pleasure.

Mr. Greenough—I did not suppose there would be any objection to the market rate of coal and petroleum being published. They are, in fact, published, I suppose, in the papers of Toronto.

Mr. Pearson—If you can get the cost of the coal and the cost of the oil, you can very soon get at the cost of the gas in the whole of it. I prefer not answering that question. I will give Mr. Greenough all the information I can upon that point privately; but I do not wish to make a statement for publication.

Mr. Littlehales—Perhaps I can give some information upon the point suggested by Mr. Greenough. We can get crude oil delivered in the neighborhood of three cents per gallon. Most of you know the cost of coal at Cleveland, or the Lake Erie ports. The freight ranges from 85 cents to $1.10 per ton of 2,000 pounds. As I said, crude oil comes to about three cents, delivered over the rail of the vessel. We get good grades of Pittsburg coal at about $4.

Mr. Pearson—It costs us a little more than that for crude oil.

Mr. Coggshall—As Mr. Pearson has referred to a saving of 15 cents per 1,000 feet of gas made, and has stated that he makes from 9,400 to 9,600 feet per ton of coal, I would state that there are works in Massachusetts, I think in Newton, that have averaged 11,600 feet per ton of coal, of 17-candle gas. The coal used is Youghiogheny, Penn, Westmoreland, or coals of that character.

A Member—I would like to ask if his meters have been tested lately?

MR. COGGSHALL—I cannot say how that is. He is using two gallons of oil to a ton of coal. I have allowed six cents per gallon for oil on the long ton, and, after taking off the fraction, the oil is 12 cents per ton of coal. I think that was the average last month.

MR. GEROULD—I would like to ask, if it is fair to compare the Lowe process of making gas with a product of 30,000 feet per bench from benches of sixes?

MR PEARSON—I did not say 30,000 feet. I said, from 35,000 to 36,000 feet. I compared it with our own make. I did not compare it with other places.

MAJOR DRESSER—As a matter of comparison with some other works, there has been a statement made here which might give the impression, in reading the proceedings, that all the companies in the United States were making gas at that rate. That cannot be fair. I think we have some others here who are able to give us some facts upon this point. Mr. Dwight, who is present, has been running six benches of sixes.

MR. DWIGHT—I have averaged, during the last year, 42,000 feet to the bench. I have made, for a week at a time, over 50,000 feet to the bench. The retorts are nine feet long, and 14×26.

THE SECRETARY—What kind of coal?

MR. DWIGHT—Penn coal, and Youghiogheny coal; I speak of the long ton.

MR. NEAL—What is the candle power?

MR. DWIGHT—The candle power was about 16 candles all the time—from that to 17.

MR. CARTWRIGHT—I have heard some criticism on the Lowe process, and I would like to ask Mr. Pearson if he made photometrical observations during the progress of the charge?

MR. PEARSON—I did.

MR. CARTWRIGHT—How did you find your gas to vary between the first of the charge and the last?

MR. PEARSON—Probably from 22 down to, say, 20, and even down to 10. There is more or less variation; but, if I under-

stand the question, to be whether we can make a uniform gas as it goes in the holder, and as it goes out in the city, I say it is a uniform gas; but there is a great variation between the first gas and the gas which is made later on.

MR. CARTWRIGHT—You find no variation after it leaves the holder?

MR. PEARSON—No; not after it leaves the holder.

MR. CARTWRIGHT—What has been the experience of your consumers? Have they found any difference between the gas supplied by the new process and that supplied by the old?

MR. PEARSON—We had some complaints from consumers, but no more than in ordinary cases. We had one complaint from a gentleman who knew that we were making gas by the new process. We sent up to his house, and found that his gas was only half turned on at the meter. Another complaint was investigated, and we found some naphtha in the pipes. In every instance where we investigated complaints, we have found the cause to be defective burners, or a partial stopping of the pipes. There has been no more of this, however, than there was by the other process. In fact, we have not had so many.

MR. HARBISON—In regard to the cost of purification, if I understand you correctly, you purify, on an average, about 10,000 feet per bushel of lime. I think you said the cost of purification was three and a half cents a thousand?

MR. PEARSON—About that.

MR. HARBISON—The cost of the lime alone would be two and a half cents.

MR. PEARSON—With lime at 22 cents a bushel.

MR. HARBISON—I understood you to say that you had three men in the purifying house. Their wages would be, at least, $1.50 per man. I understood you to state you were making 150,000 cubic feet per day. That alone would be three cents per thousand for labor in the purifying house, which, added to the cost of the lime, would make the cost of purifying 5½ cents per thousand, instead of 3½ cents, if I figure correctly?

Mr. Pearson—These men were sometimes employed for the coal gas. I made up the figures carefully before I came here.

Mr. Sherman—What is the specific gravity of this combined gas?

Mr. Pearson—The specific gravity of the combined gas, as tested by Mr. Goodwin's apparatus, was 550, if I recollect rightly.

Mr. McCauley—Is the salary of the superintendent of the works added into the cost of the gas per thousand feet?

Mr. Pearson—The salary of the foreman connected with that department is included, but I have not added in the salary of the superintendent. It would be, however, a mere bagatelle.

Mr. McCauley—There seems to be a wide difference among gas engineers as to what will enter into the cost of the gas when delivered into the holder.

Mr. Pearson—I could very soon tell you what the salary of our superintendent will be as an item of cost.

Mr. Sherman—I would like to know if Mr. Pearson has found any difficulty in the distribution of this gas; whether the mains had to be enlarged?

Mr. Pearson—Not on that account. We have enlarged our mains on account of the large increase in consumption.

Mr. Cartwright—Do you make a general distribution at the same relative pressure as before the introduction of the Lowe process, or at a lower pressure? Did you make changes in the burners?

Mr. Pearson—We made no change in the burners.

Mr. Cartwright—Did you make a change in the distributing pressure?

Mr. Pearson—We kept it a little higher.

Mr. McCauley—Have you found any difference in your loss from what is commonly known as leakage?

Mr. Pearson—I will say, in regard to that, that I have been so very busy, that I have not made up my leakage

account for the last two or three months, and I cannot answer that question. There is not any more.

Mr. Neal—I understand you to say you have two sets of gas works, an ordinary coal gas works and water gas works?

Mr. Pearson—Yes, sir.

Mr. Neal—You make your gas by these two processes, and send it out in the same holder, do you not; or do you have separate holders?

Mr. Pearson—We send it out through the same holder.

Mr. Neal—Then the gasses are mixed about half and half?

Mr. Pearson—At present it is only about one-third. It was during this summer one-half or two-thirds coal.

Mr. Harbison—Are your holders covered in; or are they exposed to the atmosphere?

Mr. Pearson—They are exposed to the atmosphere.

Mr. Harbison—I understood you to say, in answer to Mr. Cartwight's question, that the quality of the gas varied during the charge from 22 to 10 candles?

Mr. Pearson—About that.

Mr. Harbison—I also understood you to say the gas became mixed with the other gases in passing into the holder. I would like to inquire whether in your experience the variation of the temperature has been such as to affect it; and if not, whether you think a very radical change of temperature on the same day would effect it. What would be the effect upon the gas in the holder if the thermometer should fall 40° within a few hours, as it sometimes does with us?

Mr. Pearson—Do you mean in regard to its contraction?

Mr. Harbison—I mean with reference to its uniform quality?

Mr. Pearson—I cannot answer that question.

Mr. Neal—Can you give us any personal experience in regard to the manufacture, distribution and sale of water gas alone?

Mr. Pearson—I cannot. I stated in my paper exactly how that was.

MR. NEAL—Then you cannot enlighten us further on that subject?

MR. PEARSON—I have given in that paper all the facts and all the points that I am able to give.

MR. NEAL—What we want to get at, I think, is what Major Dresser has so often called "bottom facts"

MR PEARSON—I have stated in the paper all the facts I had in my possession. As I have stated before, we have only been making gas by the Lowe Process since last spring, and have been making it in connection with coal gas. I have given, in the paper which I have read, all the facts and all the data I have been able to gather from personal experience and observation of the use of this process of making gas since it was introduced at our works. We have not been making it for a sufficient length of time, and we have not been making it in such a way, as to enable me to give the most precise and definite information. We are now enlarging our works, with a view of making gas by this process on a larger scale, and after the experience of the coming year I may be able, at the next annual meeting of the Association, to give detailed and precise answers to any questions that may be asked.

MR. C A. WHITE—Do you pass your mixed gases over a heated retort to fix them?

MR. PEARSON—No, sir.

MR. BURTIS—I understood you to state that you save, on an average, about 14 or 15 cents per thousand feet. That being the case, why do you not manufacture all of your gas by the Lowe Process?

MR. PEARSON—As I have stated several times before, our works are not yet erected. We intend to use the Lowe Process altogether as soon as we can do so—when the demand is not greater than we can supply, as at present.

MR. MCELROY—I would like to ask you in regard to the naphthaline to which you have referred. What kind of weather did you have at the time of the formation of this naphthaline?

MR. PEARSON—It was pretty warm weather.

MR. MCELROY—You did not have any stoppage of the coal gas at the same time?

MR. PEARSON—No, sir.

MR. C. A. WHITE—I cannot see how there can be any naphthaline in oil gas. I have always supposed that crude petroleum vaporized was the very best thing possible to be used to clean naphthaline out of the pipes. I cannot conceive of any situation or condition of things which would permit of the existence of naphthaline in oil gas works. That is a point that I should like very much to be instructed upon. While this is not a Beecher trial, it is something similar to it in certain respects; and I for one would like to get at the bottom of what seems, to me, a very great mystery. I did have some trouble with naphthaline, though I do not have so much now, in fact, very little I am greatly surprised, however, to learn that oil gas works are troubled in this way.

THE PRESIDENT—I must confess that I was somewhat surprised when I heard the statement of Mr. Pearson that he was troubled with naphthline in his oil gas works.

MR. PEARSON—It is difficult, of course, in works where both kinds of gas are manufactured to eliminate one from the other very carefully. It is difficult to say which furnishes the most naphthaline.

THE PRESIDENT—If I understand Mr. Pearson correctly, the Lowe Process does furnish a good proportion of naphthaline?

MR. PEARSON—I believe so.

THE PRESIDENT—Of course, this is a point about which the members of the Association would be very glad to be enlightened.

MR. PEARSON—I have distinctly stated, in my paper, that we had no trouble outside of the works.

THE PRESIDENT—No trouble in the mains and pipes?

MR. PEARSON—None outside of the works.

MAJOR DRESSER—I am on Mr. Pearson's side upon this question of naphthaline in oil gas works, because I have it

from the very best authority that works making gas exclusively by the decomposition of steam by incandescent carbon, and the introduction of petroleum oil or naptha for illuminating purposes, have very serious trouble with naphthaline, so much so that they have been obliged to stop work until they could clean out the pipes. This same difficulty has been experienced by a certain company in New York, so that it has been a very serious inconvenience at times. I confess it does seem to be a singular thing, and from the experience we had previously had of naphthaline, it seems incredible; but I have had it from the most excellent authority that the thing did actually exist, and I believe the man who told me of it knew what naphthaline was.

MR. CARTWRIGHT—What New York works do you refer to?

MAJOR DRESSER—They were works making gas by the process I have described—the decomposition of steam by incandescent carbon and the introduction of petroleum or naphtha for illuminating purposes.

MR. SHERMAN—I would like to ask Mr. Pearson if he has been threatened with opposition works in his city within the last two years?

MR. PEARSON—There were opposition works threatened there between two and three years ago, but not since.

MR. SHERMAN—What process did they propose to make gas by?

MR. PEARSON—I have heard that there were some coal gas men (I do not know their names) negotiating with the parties who were about erecting these works. We have had no other Lowe gas men there at all, because we were selling gas at $2 a thousand, and I do not believe they would come into a place in our part of the country where they sell gas at that price. We are now reducing it, however, to $1.75 and $1.50.

MR. McCAULEY.—Have you found any difficulty in running your generators? We have. Our bricks become carbonized, and will not give out the heat. Do you encounter any of that difficulty in running the generators? Do you find that the bricks do not give out the heat perfectly?

Mr. Pearson—No; we did not find any difficulty of that kind. We have found that there is a slight deposit of carbon on the bricks; we also found that the bricks ran into each other, and we were obliged to take them out and put in new ones. We only lost about 200 bricks in the two generators. I believe there were about 800 or 900 altogether.

Mr. McCauley—You found that they were vitrified and run down?

Mr. Pearson—Pretty much so.

Mr. Burtis—A member has requested me to ask Mr. Pearson whether, in making up his estimate of the cost of gas, he counts in the salaries of the superintendent and foreman in both cases, or has he counted such expense in one case and eliminated it in another?

Mr. Pearson—We have two foremen, and I have put the expense of one in my estimate of the cost of coal gas, and the expense of the other in my estimate of the cost of the Lowe gas. As I have stated, we do not include the salary of the superintendent in the estimate of the cost of the Lowe gas. It would, however, be a mere trifle, and would not effect the calculation.

Mr. Burtiss—Mr. Pearson has stated that he makes one-third Lowe gas, and two-thirds coal gas. If there is such a saving in the Lowe process, why is it that he does not make a larger proportion of Lowe gas?

Mr. Pearson—Because, our consumption is so great, that we send out 400,000 feet of gas. We did not begin to make the Lowe gas until the 9th of February of this year. We made a very small percentage during February, and only really commenced running the Lowe gas works in the beginning of March. We are getting all we can out of the Lowe gas works, but our consumption is over 400,000 feet, and we cannot make more than one-third by the Lowe process, until we get our new buildings erected.

Mr. Diall—What is the largest amount of gas made in a day by the Lowe process?

Mr. Pearson—Two hundred and ten thousand feet.

Mr. Diall—The average is how much?

Mr. Pearson—We made, on an average, about 148,000 feet.

The Secretary—I do not think Mr. Pearson understood the question that was asked by Mr. Burtiss. The question, as I understood it, was this: Whether, in making up the cost of the coal gas, and, also, the cost of the Lowe gas, you included the salaries of the foremen in both cases alike? You make two kinds of gas, the Lowe gas and the coal gas, and you have a foreman for each. Did you include the salary of the coal gas foreman in your estimate of the cost of coal gas, and did you also include the salary of the Lowe gas foreman in your estimate of the Lowe gas?

Mr. Pearson—The two foremen attend to both works, or, look after both. We charge one-half of each man's labor to the Lowe gas, and one-half to the coal gas.

Mr. C. A. White—Mr. Pearson says it requires more skilled labor to run this Lowe process than it does to run the ordinary coal process. May I ask what wages you have to pay these men who run your Lowe gas process?

Mr. Pearson—We pay these men the same as we pay stokers.

Mr. C. A. White—They do not require any extra pay then?

Mr. Pearson—I think they ought to get a little more, but we do not pay them any more.

Mr. C. A. White—What do you pay stokers?

Mr. Pearson—We pay what is considered very good wages in our part of the country—$1.75 a day.

Mr. Slater—We have been asking Mr. Pearson a great many questions; but, it seems to me, that he is hardly in a position to answer them satisfactorily, either to us or to himself. The questions that have been asked are those that called for very precise and detailed information, which Mr. Pearson's present experience in the use of the Lowe process does not enable him to answer in a perfectly satisfactory manner. He has stated, over and over again, that he is making one-third of the gas which he sends out by the Lowe process, and two-thirds by the

coal gas process. He has also stated that he did not begin to use the Lowe gas process really until the beginning of March last. It seems to me, therefore, that he cannot be expected, with the experience he has had thus far, to answer every question that may be asked, or to meet every suggestion as it is made. His company propose to erect additional buildings, and continue the use of the Lowe process on a much more extended scale. If these works are put in operation during this year, Mr. Pearson will have abundant opportunity to enlarge his experience and his knowledge in relation to the practical working of this process, and he will undoubtedly be able, at the next annual meeting of the Association, to furnish the members with information of the most minute and satisfactory character. As the matter now stands, however, I do not think we can reasonably or fairly expect Mr. Pearson to answer all these questions that have been propounded. He has prepared and read a most able and interesting paper, which embodies all the facts in relation to the Lowe process that he has been able to gather from his personal experience and observation during the time that process has been in operation at his works. He can, at the present time, do nothing more than reiterate the statements he has made, and it therefore seems to me that the question had better be left where it now stands until Mr. Pearson, after a more enlarged experience and more extended observation, shall be able to give us the information which it is not now in his power to furnish.

MR. PEARSON—As the Secretary has stated, I was very much opposed at first to preparing any paper on the subject, and I only did so at his most urgent solicitation. I have given in that paper all the information I can give you at the present time. I tried to make it as intelligible as I could. I cannot tell you about the results of the process, using it as we have been using it, and for the short time it has been in operation at our works; and nobody can reasonably be expected to do so. I am quite prepared to give you all the information I possess, and I think I have already done so.

MR. SHERMAN—The capital account has, in my judgment, more to do with the price of gas to our consumers, than any

process. I would like to ask Mr. Pearson, what the capital of his company is?

MR. PEARSON—$600,000.

MR. M. S. GREENOUGH—I would like to ask Mr. Pearson if he included in the cost of the coal gas, the cost of plant, etc.?

MR. PEARSON—Yes.

MR. DIALL—Mr. Pearson states that we will save 15 cents on the gas manufactured by the Lowe process, manufacturing at the same time two-thirds coal gas. He says, also, that the coal gas was selling for $2, and that now it is selling for $1.75; and the statement is made in such a way as to leave the impression on the minds of some of the members of the Association that the reduction was made in consequence of the introduction of the Lowe process. What I want to know is whether or not this reduction was made upon the anticipated merits of the Lowe gas?

MR. PEARSON—Partly.

MR. DIALL—Yet he does not show any results that would warrant any such reduction for that reason. Either they were charging too much for their coal gas, or the results of the Lowe process were greatly exaggerated, because he has not yet developed anything to justify the reduction.

MR. PEARSON—We expect to do a great deal better than that when we get our additional works erected. The reduction was made for good and sufficient reasons, and we have not, thus far, found any cause to believe that we made an error in judgment. The results of the Lowe process have been sufficiently satisfactory to us to warrant us, as we think, in extending our works and continuing the use of the Lowe process upon a much larger scale.

THE PRESIDENT—I suppose you continue this system of manufacturing both kinds of gas until the material for one kind or the other advances to such an extent that you cannot afford to use it. Are you aware that the cost of oil has advanced sixty per cent in the last two or three months?

Mr. Pearson—I am aware that it has not done so in Canada. I can purchase it as cheaply now as when we made our contract.

The President—Do you not know it to be a fact, that petroleum has advanced in value in the American market 60 per cent within the last month or two, and is still advancing, and likely to advance?

Mr. Pearson—I am quite well aware of the fact that there are fluctuations in the market price of petroleum; but we have an understanding that we shall get our petroleum cheaper than ordinary consumers can purchase it, as we are getting it to-day, and I am pretty well convinced that, with the present understanding we have, we will probably be able to get it as cheap next spring, when our contract expires, as we are getting it to-day.

The President—You do not suppose, do you, that if petroleum should advance to four times its present value, you would still be able to buy it at a very low price?

Mr. Pearson—I do not know how we will be able to buy it; but I have every reason to believe that we could buy it much cheaper than ordinary consumers.

Mr. Helme—There is one thing to be said about this question of the price of petroleum. As I understand it the Canadian petroleum is an inferior article compared with that which comes from this State; and until the petroleum which is produced here becomes very much higher, I doubt very much whether the price of petroleum in Canada will be very greatly affected. Is not the petroleum produced there inferior to ours?

Mr. Pearson—It is inferior.

Mr. Helme—And, therefore, until the petroleum in this market gets very much higher, the price of petroleum there will not be affected.

Mr. Pearson—I believe that to be so.

The President—Don't you think that the Canadian market would sympathize with the American market, if the price of petroleum advanced here from 60 to 100 per cent.?

Mr. Pearson—I cannot speak positively as to that.

The President—What kind of a position will you be in for making petroleum gas when the petroleum market advances to four or five times its present value?

Mr. Pearson—It will make a very considerable difference in making the gas if that time ever comes. There can be no question about that.

Mr. McIlhenny—I would like to ask Mr. Pearson if he has made any calculations as to what the result would be if all the companies in the United States made gas from oil? Because, if the process is so much superior, as Mr. Pearson evidently thinks it is, all the companies in the country will adopt it. I think Mr. Pearson has given us a very fair and impartial statement. He has given us the cost upon both sides, so that we can easily calculate it for ourselves. He has told us how much labor and material it takes to make a thousand feet of both kinds of gas; and I think we are under many obligations to him for the clear and explicit manner in which he has stated the facts. I would like to ask him whether, owing to its great superiority and cheapness, he anticipates the universal use of petroleum for making gas; and, if so, whether he has calculated what the commercial effect upon the market will be?

Mr. Pearson—I do not anticipate that it will be universally used in the United States, but I do think it will be in Canada. If it is, we have such an abundant supply that all the gas companies could use it, and such use would have very little effect upon the price.

SECOND DAY—October 16, 1879.

Mr. Neal—It seems to me that the discussion of this paper has been prolonged to a considerable extent, and, as the subject seems to be pretty nearly exhausted, I move that the thanks of the Association be tendered to Mr. Pearson for his valuable paper, and also for the kind and courteous manner in which he has responded to the many questions that have been asked him.

The President—I disclaim any intention of impeaching, in the slightest degree, the value of Mr. Pearson's article. I thought perhaps he went a little out of his way to tell what had been done in other places in respect to the Lowe process, when it was a well-known fact that it had not been in use in some of those places—especially in Utica—for a long time. I think we all expected that Mr. Pearson would give us a statement of his personal experience.

Mr. Pearson—I did not know whether all the members understood how the process worked, and I did not think it was unbecoming in me to give a brief history of the introduction and operation of the process in other places; and I did so in introducing my paper; and, with all due deference to the Chair, I think it was a very proper introduction.

Mr. Harrison—I heartily agree with Mr. Pearson upon that point, and I hope he will not stop the investigation here. His paper has been very interesting and instructive. His experience has not been sufficient for him to satisfactorily answer many inquiries, but he has given us all the information he has at his command, derived from his experience and observation during the few months the process has been in operation at his works. His statistics are very satisfactory and clear so far as they go, and reflect a great deal of credit upon him: I think the thanks of the Association are certainly due him—not only for the information he has given us in his paper, but also for the frank and courteous manner in which he has answered our inquiries. I trust that he will continue to gather statistics from the practical working of the process during the current year, and that when we meet again he will be able to give us further information. He will then have passed through a year's experience, and some questions which he could not answer to-day he will then be able to answer; and I have no doubt he will cheerfully do so. I therefore move, Mr. President, that he be invited to continue his investigations and report the result at our next annual meeting.

Mr. Neal—I accept that as an amendment to my motion.

The President—The motion is, that a vote of thanks be

tendered Mr. Pearson for his valuable paper, and for the courteous manner in which he has answered the questions propounded to him; and also that he be requested to continue his observations and report at the next annual meeting.

Carried.

MR. NEAL—There is a paper that has been handed to the Executive Committee for their approval, written by Mr. Farmer, on the Dieterich furnace.

MR ALLEN—I understood that an opportunity was to be offered to members to discuss the subject of water gas generally. I did not understand the discussion to be confined to the Lowe process, but to be upon water gas as compared with coal gas. I think Mr. Pearson has not been able to examine the subject long enough to give us definite information, and it seems to me the subject should be further discussed.

THE PRESIDENT—I will state to the gentleman that in the reply I made to his question some time since, I did not mean to commit the Association to any particular order of business. The order we adopted this morning was to listen to the reading of the papers, and then to discuss the questions that might be raised by them. In pursuance of that order we heard the paper of Mr. Pearson read, and the members of the Association have been asking and he has been answering questions. The discussion upon that paper is now closed. Other papers are to be read, and our time is short. Unless the Association decree it by vote, it will not be proper to depart from the regular order of business; but if, after all the papers have been read and the discussion upon them closed, there is sufficient time remaining, you will have an opportunity to be heard, if the Association should so direct.

MR. ALLEN—It seems to me to be hardly fair that the discussion of so great a question should be confined to one paper.

THE PRESIDENT—Have you a paper?

MR. ALLEN—I did not prepare any paper. I supposed that after all these questions had been asked and the subject presented, it would be legitimate for me to speak upon it.

THE PRESIDENT—The special subject under consideration was the Lowe process as used at Toronto, and not the water gas question. Now we have disposed of that question, and unless the Association direct, I do not propose to depart from the regular order of business.

MR. MCILHENNY—I hope, if any time can be spared, that Mr. Allen will be heard. So far as I am concerned, I have no desire to shut off discussion on any subject; and if Mr. Allen has anything to say that will be of interest, I hope he will have an opportunity of saying it.

MR. ALLEN—A great deal of time was spent in asking questions upon a matter that was merely local.

THE SECRETARY—If Mr. Allen will listen to me for a moment, knowing as I do the condition of the business before the Association, I think he will be satisfied that the regular order should be adhered to, and that the discussion of the water gas question should come at a later period.

MR. ALLEN—I am perfectly willing to abide by the wishes of the Association.

THE PRESIDENT—We have considerable business before us that has been approved by the executive Committee. Of course, it is for the Association to decide whether they will go on with the regular order of business or take up the water gas question.

MR. NEAL—I move that the regular order of business be adhered to.

Carried.

THE PRESIDENT—The next thing in order is the paper by Mr. Farmer, which will be read by Major Dresser.

MAJOR DRESSER—Mr. Farmer has requested me to read this paper for him in his absence. I suppose you are all aware of the general features of the Dieterich furnace. In a few words, it is simply placing the furnace beneath the bench and in front of it, and hauling the hot coke from a portion of the retorts into this furnace, and then the products of combustion are carried up into the same chamber or oven as in the ordinary set-

ting. It amounts practically to enlarging the furnace itself by deepening and broadening it in front of the bench.

Major Dresser then read the paper of Mr. Farmer as follows:

THE DIETERICH FURNACE.

To make a long story as short as possible, we will begin at once with the claims made by Mr. Charles F. Dieterich, and then wind up with some comparisons and results.

1. That 2½ per cent of Cannelton cannel in the mixture will give by this process the same yield and candle power as 5 per cent of the same will give by the ordinary process; and that this increase is brought out by the high and constant temperature which is maintained in every part of the oven, and especially at that part next the mouth-piece. It thus at all times converts the tarry oil into a rich and fixed gas, instead of into a vapor, which is generally generated at the front of the bench for a certain time after the charge of coal is put in.

To make this claim a little clearer, we will convert it into a more simple form—

When 2½ per cent of the Cannelton cannel is used in the mixture and burnt off in the ordinary bench, we generally obtain about the following results:

2½ per cent of Cannelton × 252 candle feet.	630
97½ per cent of Penn × 70 candle feet.....	6,825
100	7,455

And one pound of the mixture will yield 74.55 candle feet.

When 5 per cent of the Cannelton cannel is used in the mixture and burnt off in the ordinary bench, we generally obtain about the following results:

5 per cent of Cannelton × 252 candle feet......	1,260
95 per cent of Penn × 70 candle feet	6.650
100	7.910

And one pound of the mixture will yield 79.10 candle feet.

Hence $\frac{(79.10-74.55)\times 100}{74.55} = 6.10$ per cent is the actual gain

in the yield candle power together.

Accordingly, if we put 2½ per cent of the Cannelton cannel in the mixture for each bench or process, than the yield per pound from the Dieterich bench will be about 6.10 per cent greater than that obtained from the ordinary bench.

Therefore the coefficient for the Penn coal when carbonized in the ordinary benches will be about 70 candle feet; and when carbonized in the Dieterich benches will be about

$$70 + \frac{70 \times 6.10}{100} = 74.27$$ candle feet per pound. Accordingly the coefficient of the Cannelton cannel, when carbonized in the ordinary benches, will be about 252 candle feet, and when carbonized in the Dieterich bench will be about

$$252 + \frac{252 \times 6.10}{100} = 267.37$$ candle feet per pound.

2. "That the Dieterich bench will burn off 225-pound charges in three hours, or 10,800 pounds of coal in the 24 hours, just as readily as the ordinary bench will burn off 200-pound charges in four hours, or 7,200 pounds of coal in the 24 hours. Accordingly the Dieterich bench will burn off 50 per cent more coal in the 24 hours than that generally burnt off in the ordinary bench in the same time.

3. "That one of these benches can be run during the 24 hours, with only 1.66 men, in the place of 2 men, which are generally required to run the ordinary bench for the same time. And also that one man can attend to from 16 to 20 of the fires."

Consequently this will reduce the labor account just 17 per cent.

4. "That 25 per cent of the coke which is made will burn off the 225-pound charges in the Dieterich bench just as easily as 40 per cent of the same will burn off the 200-pound charges in the ordinary bench."

Accordingly this reduces the fuel required for the bench 37½ per cent below that required for the ordinary bench.

We will now compare the work done by one of these benches with that done by one of the ordinary benches, and

for this purpose we will take two benches of sixes, in which the retorts are each 12″×20″×8′ 6″ long.

The following items will give the coals used, the products and the imaginary prices:

Penn coal, at $5.50 per gross ton delivered in the yard yields about--

70 candle feet per pound by the ordinary process.
38 bushels of coke per ton, worth 4 cents per bushel.
10 gallons of tar per ton, worth 2 cents per gallon.
20 gallons of liquor per ton, worth ½ cent per gallon.

97½ per cent of this will be required in the mixture to yield 79.10 candle feet per pound by the Dieterich process, and 95 per cent will be required in the mixture to yield the same by the ordinary process.

Cannelton cannel, at $10 per gross ton delivered in the yards yields about—

252 candle feet per pound by the ordinary process.
32 bushels of coke per ton, worth 3 cents per bushel.
10 gallons of tar per ton, worth 2 cents per gallon.
20 gallons of liquor per ton, worth ½ cent per gallon.

2½ per cent of this cannel will be required in the mixture to yield 79.10 candle feet per pound by the Dieterich process, and 5 per cent will be required in the mixture to yield the same by the ordinary process.

Cost of the Gas when made by the Ordinary Process.

Retorts, 12″×20″×8′6″ long. One of these benches will burn off about 7200 pounds, or 3.214 tons, of a mixture compounded of 95 per cent of Penn coal and 5 per cent of Cannelton cannel in the 24 hours, which will yield 79.10 candle feet, or 4.943 cubic feet, of 16-candle gas per pound.

Accordingly we shall have 6840 pounds, or 3.054 tons, of the Penn coal, and 360 pounds, or 0.160 tons, of the Cannelton cannel in the mixture; and the cost of the gas will be as follows:

Debtor.

3.054 tons of Penn coal, at $5.50	$16.79
0.160 tons of Cannelton cannel, at $10	1.60
2 men, at $2.50 per day each	5.00
50 bushels of coke, at 4 cents per bushel	2.00
Wear and tear of bench at 78 cents	.78
Total cost of labor and materials	$26.17

Creditor.

116 bushels of Penn coke, at 4 cents	$4.64	
5 bushels of Cannelton coke, at 3 cents	.15	
32 gallons of tar, at 2 cents	.64	
64 gallons of liquor, at ½ cent	.32	
		$5.75

Total cost of gas make from 7200 pounds of mixture. $20.42

6840 pounds of Penn × 70 candle feet	478,800	candle feet.
360 pounds of Cannelton × 252	90,720	"
7200 pounds of the mixture yields	569,520	"

Hence, 1 pound of the mixture will yield $\frac{569,520}{7200} = 79.10$ candle feet; and 1000 candle feet will cost $\frac{20.42 \times 1000}{569,520} = 3.585$ cents. Or 1000 cubic feet of 16-candle gas will cost $3.585 \times 16 = 57.36$ cents.

Cost of the Gas when made by the Dieterich Process.

Retorts, 12″ × 20″ × 8′ 6″ long. One of these benches will burn off about 10,800 pounds, or 4.820 tons, of mixture compounded of 97½ per cent of Penn coal and 2½ per cent Cannelton cannel, in the 24 hours, which will yield 79.10 candle feet per pound, or 4.943 cubic feet of 16-candle gas.

Accordingly we shall have 10,530 pounds, or 4.70 tons, of the Penn coal and 270 pounds, or 0.12 ton, of the Cannelton cannel in the mixture ; and the cost of the gas will be as follows :

Debtor.

4.70 tons of Penn coal, at $5.50	$25.85
0.12 tons of Cannelton cannel, at $10	1.20
45.79 bushels of coke, at 4 cents	1.83
1.66 men, at $2.50 per day each	4.15
Wear and tear of bench, at $1.07	1.07
Total cost of labor and materials	$34.10

Creditor.

178 bushels of Penn coke, at 4 cents	$7.12	
4 bushels of Cannelton, at 3 cents	.12	
48 gallons of tar, at 2 cents	.96	
96 gallons of liquor, at ½ cent	.48	
		$8.68

Total cost of gas made from 10,800 pounds of mixture, $25.42

10,530 pounds of Penn × 74.27 candle feet..782,063.10 candle feet.

270 pounds of Cannelton × 276.37........72,189.90 candle feet.

10,800 pounds of the mixture yields........854,253.00

Hence, 1 pound of the mixture will yield $\dfrac{854,253}{10,800}=79.10$ candle feet; and 1,000 candle feet will cost $\dfrac{25.42\times 1000}{854,253}=2.975$ cents. Or, 1000 cubic feet of 16-candle gas will cost $2.975\times 16=47.60$ cents.

Recapitulation.

The Dieterich bench produced	854,253	candle feet.
Ordinary bench produced	569,520	"
Difference per day	284,733	candle feet.

Accordingly the yield obtained from the Dieterich bench was $\dfrac{284,733\times 100}{569,520}=50$ per cent. more than that obtained from the ordinary bench.

Or, in other words, one of the Dieterich benches is equivalent to one and a half benches of the ordinary construction.

The Dieterich bench will make $\frac{854{,}253}{16} = 53{,}391$ cubic feet of 16-candle gas in the 24 hours, which will cost 47.60 cents per 1000 cubic feet when the prices for materials and labor are as before mentioned.

The ordinary bench will make $\frac{569{,}520}{16} = 35.595$ cubic feet of 16-candle gas in the 24 hours, which will cost 57.36 cents per 1000 cubic feet.

53.391 cubic feet of 16-candle gas, at 57.36 cents per 1000	$30.62
53,391 cubic feet of 16-candle gas. at 47.60 cents per 1000	25.41
Extra cost of gas made by the ordinary bench	$5.21

Accordingly the Dieterich bench saves per day $5.21; per year, $1,901.65.

Dieterich Process.

Cost of material and labor per 1000 cubic feet of gas:

Coal per 1000 cubic feet, $\frac{27.05 \times 1000}{53{,}391} = 50.66$ cents.

Coal, minus value of residuals $\frac{(27.05-8.68) \times 1000}{53{,}391} = 34.40$ cts.

Labor per 1000 cubic feet, $\frac{4.15 \times 1000}{53{,}391} =$ .... 7.78 cts.

Fuel per 1000 cubic feet, $\frac{1.83 \times 1000}{53{,}391} =$ .... 3.42 cts.

Wear and tear per 1000 cubic feet, $\frac{1.07 \times 1000}{53{,}391} =$ .. 2.00 cts.

Total cost of the gas per 1,000 cubic feet........47.60 cts.
Yield per bench of sixes in the 24 hours..53,391.0 cubic feet.
Yield per retort, 20″×12″×8′ 6″ long... 8,898.5 cubic feet.

As the price of the coal in New York is now 18 per cent. lower than the imaginary prices used in the preceding calculations, the cost of the coal and gas will be as follows if we allow for that reduction :

Coal, per 1000 cubic feet.................. 41.55 cents.
Coal, minus value of residuals............. 28.21 "
Gas per 1000 cubic feet................ ...41.41 "

Ordinary Process

Coal per 1000 cubic feet, $\dfrac{18.39 \times 1000}{35{,}595} = 51.66$ cents.

Coal, minus value of residuals $\dfrac{(18.39-5.75) \times 1000}{35{,}595} = 35.51$ cts.

Labor per 1000 cubic feet, $\dfrac{5.00 \times 1000}{35{,}595} =$...... 14.04 cts.

Fuel per 1000 cubic feet, $\dfrac{2.00 \times 1000}{35{,}595} =$........5.62 cts.

Wear and tear per 1000 cubic feet, $\dfrac{0.78 \times 1000}{35{,}595} = 2.19$ cts.

Total cost of the gas per 1000 cubic feet..... 57.36 cts.
Yield per bench of sixes in the 24 hours, 35,595.00 cubic ft.
Yield per retort, 20″ × 12″ × 8′ 6″........5,932.50 " "

And when we take off the 18 per cent. reduction for coal as before mentioned, the cost of the coal and gas will be as follows:

Coal per 1000 cubic feet of gas.............42.37 cents.
Coal, minus value of residuals. ....29.12 "
And the gas therefrom per 1000.............50.97 "

Our figures give the cost of the gas at the exit of the retort house when the benches are in perfect order; consequently an allowance must be made in practice for imperfect benches and scurfing. But this allowance will not affect the general ratio existing between the two systems.

By substituting other figures for those used in the preceding

formulas for the cost of coal, labor, coke, etc., results may be obtained which will accord with the same in any locality.

The average yield from the Dieterich benches for the month of August last was 51,042 cubic feet of gas per bench, or 8,507 cubic feet per retort; and included the retorts which were missing and scurfing.

The average yield per pound of coal was 5.07 cubic feet of 17,83 candle gas, and the tests were made on the standard 15-hole Argand burner.

The maximum yield per retort during the time before mentioned was 9,125 cubic feet.

On motion of Mr. Neal, the Association passed a vote of thanks to Mr. Farmer for his paper, and then took recess until 3 P. M.

Afternoon Session.

Convention called to order at 3 P. M.

The President—It seems desirable to appoint a Committee of Arrangements for the meeting to be held next year at Chicago, and this seems to be a very good time to attend to that matter.

Mr. Neal—I move that a committee of three be appointed to make arrangements for the meeting to be held next year at Chicago.

Carried.

The President—It was arranged at this point in our proceedings to have a lecture by Mr. Page upon "Coal Tar Distillation;" but as he is out for a moment, we will have a paper read, written by Mr. Cathels, upon "Retort Settings."

Mr. Neal—After the paper is read I desire to make a report from the Finance Committee. A majority of the Finance Committee have requested me to propose the name of Mr. Benjamin F. Archer, director of the Camden Gas Light Company, of New Jersey, as a member of this Association. His application is indorsed by Mr. Goodwin and myself. I move that the usual course be taken.

Carried.

The Secretary was authorized to cast a ballot on behalf of the Association for the election of Mr. Archer to active membership.

Major Dresser was appointed teller, and declared Mr. Archer to be unanimously elected an active member of the Association.

MR. NEAL—Prof. Love is present, and has a paper prepared upon "Standard Burners." This paper was approved by a majority of the Executive Committee.

THE PRESIDENT—It will come immediately after the reading of Mr. Cathels' paper.

Major Dresser then read the paper by Mr. Cathels on "Retort Settings," as follows:

A FEW SUPPLEMENTARY WORDS ON RETORT SETTINGS, ESPECIALLY WITH REFERENCE TO SMALL GAS WORKS.

At the risk of being regarded by some as having retorts on the brain, I venture to recur to the important question in the economy of coal gas works of the methods of setting the retorts, in a few supplementary words, in introducing to the meeting some working drawings of settings suitable for small works.

The smallest gas works can be carried on relatively as successfully in their way as the largest, but then the ways are as different as the ways of those who, being restricted to limited means, have to contrive by wisely moderated desires and the exercise of a careful and judicious expenditure to make ends meet, and their richer neighbors, who can enjoy the goods the gods send in a luxurious way denied to others whose lines have not fallen in such pleasant places. Much that is considered nowise extravagant in the more liberal and ornamental equipment, and in the manner of conducting the business of large gas companies, has to be rigidly eschewed in small works. Especially has outlay on appearances to be denied. Utility must be the chief, if not sole consideration, if the undertaking is to be made to pay. But, on the other hand, niggardliness should not be carried so far as to starve the concern. It is mistaken economy not to allow the workman good tools. The

farmer who impoverishes his land will reap but poor crops; nor will a gas company, especially with makeshift retort settings, be likely to prosper.

A friend of the writer in England—a gas engineer of large practice—once gave him as his reason for becoming connected with the gas works of a very small town, his desire to learn how such works were managed; and it having been the writer's lot during the last year or two to serve a similar apprenticeship, the necessity presented itself of providing suitable settings, and it has been suggested that the production here of the drawings of some of them might perhaps be acceptable.

That part of the plant of small works he has often found to be faulty, either in the retorts not heating properly, or in too large a consumption of fuel; and generally in the retorts not wearing well. As an instance, he had occasion two years ago to make a valuation of small works, and subsequently to carry them on. There were two beds of three clays each, which appeared in fairly good condition, one of them not having been long set; but they were found to require as much fuel as should suffice for good settings of six or seven retorts, and after a few weeks' working the top retort of the older bed fell to pieces, and the other bed was not long in following suit. As was surmised, the retorts were found to be without any struts or jams, sufficiently explaining what had happened.

Even if retorts in small works are not subjected to worse usage than in large ones, there is at any rate the want usually of experienced labor to make good the defects of wear and tear, they should be set on the best possible plan, and with particular regard to stability; but, as already said, as their building is generally done by men unaccustomed to such work, the setting or plan should not be too complicated.

It is frequently found in such works that the arrangement is bad in respect of the number of retorts set together. There will probably be, say, two beds of three each, as in the case just referred to, instead of the six retorts being divided into one, two and three, to suit the varying requirements of the year; so that at certain seasons they cannot be charged regularly, resulting in bad gas, unnecessary consumption of fuel,

injury to the retorts, and waste of coal by the gas escaping through the inevitable cracks in the retorts when just charged after lying off for a time.

It is very desirable, too, that there should be one iron retort set separately in every small works, for the convenience of being brought into action in emergencies, as it is much less liable to injury by lighting up and letting down than a clay one. When properly protected from the direct action of the furnace flame, as shown by the drawing on view, such a retort, with occasional short spells of work, will last for years, if care be taken to exclude air when let down. It possesses the great advantage of being absolutely tight, so that when ready to be charged all the gas from the first goes into the holder, instead of the production of the first two or three charges going mainly up the flue, as in the case of a clay retort so used—a matter, at such a juncture, of the first importance.

The drawings exhibited show both the horizontal and vertical ways of heating, two and three chambered arrangements being respectively illustrated in the latter system. It will be seen that the retorts in each plan are so well strutted as to greatly strengthen the structure, and make it almost impossible, in case of cracks in the retorts, for a piece to fall out of its place, and enables cracks to be easily filled up.

It will also be observed that the furnaces are proportionately somewhat larger. That is found to be desirable to enable the men in charge to leave for a considerable time to attend to outside complaints, etc. Their sides, too, are sloped to a minimum width at the fire bars, which prevents influx of cold air as the furnace charge burns away, by the coke sliding down and keeping the air spaces covered until nearly the whole is consumed. The protecting arches, as will be seen, are not disturbed by the relining of the furnaces.

Among the exhibits will be found an unfinished, hastily-made drawing of a peculiar arrangement of three retorts, by my friend Mr. Littlehales, designed for arches too small to admit of the retort being disposed in the ordinary way. It may be described as a setting of four (one of which is on view), with the furnace occupying the space of one of the lower retorts

By this contrivance three can be set in a narrower arch than could be done with the furnace in the usual position. The setting is otherwise a three chambered one. He has, during the last few years, set several beds on this plan, which have been found to give entire satisfaction, both as respects heating and life of the retorts. It is a happy idea, which the writer had not seen or heard of before.

Although the drawings are intended more particularly as examples of settings applicable for small works, there are also settings shown of five and six retorts respectively, as examples of the principles of some of the smaller settings extended to larger ones.

The paper was accompanied by a large number of drawings, which were placed upon the blackboard.

MAJOR DRESSER—Mr. Littlehales desires me to say that if any member of the Association wishes any explanation of these drawings he will be very happy to give it, as he is entirely familiar with them.

MR. C. A. WHITE—I move that the thanks of the Association be tendered to Mr. Cathels for the paper to which we have just listened.

Carried.

DR. LOVE—At the suggestion of the Secretary of the Association I prepared, somewhat hastily, a short paper on "Standard Burners," which, with your permission, I will now read.

Dr. Love then read his paper, as follows :

STANDARD BURNERS.

The question of a proper burner for testing the illuminating power of gas has created about as much if not more discussion than that of a proper standard with which to compare the illuminating power.

In 1849 Parliament first legalized a standard of the illuminating power of coal gas. The burner was described as an Argand of 15 holes, consuming 5 cubic feet of gas per hour, and having a seven-inch chimney. The candles were made of

wax, six to the pound, and, as at present, intended to burn 120 grains per hour. In 1850, Dr. Letheby was appointed the first gas examiner, and to him are due many of the improvements in photometric work. Two years after his appointment, the sperm candle was substituted for the wax, and a plaited wick used.

The first Public Act fixing a standard of illuminating power was the Metropolitan Gas Act of 1860, in which the burner prescribed was an Argand of 15 holes, consuming five cubic feet of gas per hour, and having a 7-inch chimney; the standard of illuminating power was continued at 12 candles, and the candles employed were made of sperm. It will be readily seen that with these very imperfect specifications as to what the standard burner should be, a great variety of burners could be constructed, each conforming to that mentioned in the Parliamentary Act. Nothing was said about the size of the apertures, and their distance apart, the diameter of the channel through which air was supplied to the interior of the flame, no diameter of chimney given, and so on. As might have been expected, burners were made which did not show more than 50 per cent of the illuminating power of the gas. It was noticed, however, that the smaller the holes and the greater the pressure, the lower the illuminating power; and, also, that as the channel for carrying air to the interior of the flame increased in size, the illuminating power was diminished. With this knowledge as to what a burner should not be, it became merely a matter of patient study and experiment to make a burner what it should be.

The Birmingham and Staffordshire Gas Act, of 1864, contained a feeble effort to describe a standard burner; but it was still incomplete, although an improvement on those preceding it. The Birmingham burner, although well-suited to a 14-candle gas, for which it was designed, proved unfavorable to the gas if the illuminating power was greater or less than this.

The Lemington, Dublin and other burners were used more or less as standards; but the burner containing more good qualities than any other that had preceded it, and one which

at the present time is quite extensively used, was that designed by Dr. Letheby, and made by Mr. Sugg, and now known as the Sugg-Letheby burner.

In the "City of London Gas Act," of 1868, an entirely new departure was made. By it Gas Referees were to be appointed, and, among other duties, they were to "prescribe the burner for testing the illuminating power of the gas," which burner should be "most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer."

The result of this Act was the adoption, in 1870, of a burner constructed by Mr. Sugg, and known as "Sugg's London Argand, No. 1." He gave the matter much careful study. The pressure under which the gas was supplied to the burner was greatly reduced; the air supply to the interior of the flame was carefully regulated by the diameter of the air hole in the centre, while the air supply to the exterior of the flame was regulated by the length and diameter of the chimney; the temperature of the burner was also greatly reduced. While with a Sugg burner the pillow becomes heated to a distance of two or three inches from the top, with a Sugg's London the gas channels of the burner itself are not even warm.

"Calling the old test burner used from 1852 to 1863, 100, the steatite burner used from 1863 to 1869, equalled 111.1, while the Sugg's London equals 128."

The burner now used by the Gas Referees in London is practically the same as that adopted in 1870, and some changes in the dimensions of the chimney have been made.

There are three elements to be considered in the construction of a standard burner or any burner calculated to utilize to the fullest extent the power of the gas:

1st. Size and number of holes.

2d. Air supply.

3d. Chimney.

I am speaking now of burners of the Argand pattern.

First: The size and number of holes.—With common coal gas (say 16-candle gas) the holes can be of larger diameter and

fewer in number as the illuminants are in moderate quantity, and too great surface of flame must not be exposed tó the oxidizing action of the air. With richer gases the case is different. Here we have a larger per centage of illuminants, and the object is to spread out the flame and allow the air a fair chance to bring the carbon particles to incandescence. Hence the number of holes is increased and they may be of smaller diameter.

Second: The second and third elements (air supply and chimney) are closely related, because as we vary the dimensions of the chimney we vary the supply of air. The air supply is really the most important consideration, for on it depends the development of the maximum amount of light. A rich gas can stand and needs more air than a poor gas, inasmuch as in the rich gas we have more matter to be oxidized. The heated column of air caused by the burning gas creates a current of the surrounding air towards itself. This drawing in of the air is increased with an increase of the velocity with which the gas issues from the apertures.

This increase of the air supply results in a more rapid combustion of the gas. It is possible to make the combustion too rapid, in which case the gas is overburned. On the other hand, if the combustion is not rapid enough, a loss of light ensues, and we say the gas is underburned.

As the combustion becomes more intense (by increasing the air supply) the *intensity* of the luminous portion of the flame increases, although the *extent* of the luminous portion is continually decreasing.

With a deficiency of air the flame temperature is too low, and when there is too much air, its inert nitrogen is heated at the expense of the flame, and the carbon particles, mingled to a greater extent with the air, pass through the incandescent state too rapidly, or it may be the flame temperature is too low on account of the excess of air. There is a point then at which the carbon particles receive just the amount of air necessary to develop the maximum of light, and below and above which the gas suffers.

Third: It is evident that as the chimney is increased in length or width, a greater quantity of air is drawn in on the flame, and so it may be over or unburned, according as the chimney is too large or too small. The flame will give its maximum of light on the verge of smoking.

There never has been a standard burner in the proper acceptation of the term. One burner after another has been adopted in certain sections because the newcomer was supposed to give more satisfactory results than its predecessors. This country has not, and never has had, any one burner which, by general consent, was accepted as a so-called standard.

In England much more attention has been paid to the subject, and since the Gas Act of 1868 a certain burner has been adopted which utilizes the power of the gas so far as our knowledge of the principles involved will enable us to construct one. The same burner is not used by all gas corporations in England even, and hence cannot properly be called a standard in the same way that we speak of standards of weight and measure. We have the Sugg's London, the Sugg-Letheby, and many more, each dubbed "standard." It probably never will be possible to decide on any one burner, and, except for the advantage of comparison, it is of little moment. In this country if every gas company made the same kind of gas, and in the same way, we might settle on some one burner, but variety seems to be the order of the day. Burners were made for gas, not gas for burners, and it is very important to select a burner which is suited to the gas it is used to test. A burner adapted to a 16-candle gas will not burn one of 14 or 18 candles without injury to the gas. Sometimes it is possible to correct the evil by using a chimney of different dimensions.

Such is the case in using the burner prescribed by the Referees in testing the gas of London. If in testing a 14-candle gas by this burner it shows a tendency to tail over the chimney, the latter is changed for one of a slightly increased diameter. It then becomes an interesting question as to how far it is possible to decide on a burner which a majority of gas corporations can use to advantage. If one has always

used the Sugg-Letheby burner, he could always continue doing so, and be able to compare the quality of his gas to-day with that of six months or a year previous. But if one company uses a Sugg's London, and another a Sugg-Letheby, there is no means of comparison, except as we know in a very general way, the increased illumination given by Sugg's London over the Sugg-Letheby.

Further than this the question arises, and a question of much more scientific interest. How much light can be obtained from a given gas under the most favorable conditions. In these times of close competition no gas corporation can afford to lose two or three candles illuminating power in the burner.

Every illuminating gas contains elements which, under favorable conditions, will emit a certain amount of light.

The burner does not increase this light-giving power contained in the gas, but simply utilizes it to a greater or less extent, according to the adaptability of the burner to the gas.

That the gas company has a right to employ, in testing for illuminating power, the burner which will show its gas to tne best advantage, is a fact generally conceded, and one which few, if any of you, will question The intelligent consumer, on the other hand, has a right to demand that these tests be made with a burner which he can readily obtain. In other words the company has no right to employ a burner of intricate construction, one likely to get out of order, or one so expensive as not to be within the reach of consumers. In most cases it will be found that the use of poor burners is occasioned more through ignorance than any inability to procure good ones.

In England, of late years, great advancement has been made in the use of proper burners by consumers, and burners similar to those prescribed by the Referees can be readily obtained. We hear little of English burners in the hands of consumers in this country because there is little thought given to the subject, and hence little demand for any other than the most simple forms. They are not so expensive, however, as to preclude their use in photometric work so far as it may be advantageous to employ them.

The question is—can a burner be wisely adapted for use by a large number of gas companies, unless there is some approach to equality in the gas manufactured by them. If one company makes a gas of 14 candles, and another company one of 18 candles, certainly no one burner can be used advantageously for both. If there were some standard of illuminating power, say 16 candles, and the different companies endeavored to keep near this, a burner could be easily selected, which, within reasonable limits would answer for all. If a burner were to be adopted for what are known here as naphtha gases, it would need to be something different from that for coal gas. In England the Referees prescribe an Argand burner for common coal gas, ranging from 14-candles to 16-candles, and a batwing-burner for cannel gas (ranging from 23 to 28 candles.)

I have had occasion to make some experiments on the subject in connection with a proposed change of burner in testing the gas of New York city, and, without occupying your time with details, will mention some of the conclusions to which I have been drawn.

New York is epecially fortunate, or unfortunate, in the great variety of illuminating gases offered to the public. At present (and ever since the city has had testing stations under its control) the Sugg-Letheby burner has been employed for all gases alike. That this burner was not doing full justice to any, and great injustice to some of the gases tested by it, was evident to every one; but, for certain reasons, no change seemed possible at the time. And even now, that a change is contemplated, it is a most perplexing question to decide what burner or burners to adopt. To adopt one burner for all would be ridiculous. In the first place, there are gases like the New York and Harlem having an illuminating power of 16 to 17 candles, (tested by the Sugg-Letheby), and whose specific gravity is that of ordinary coal gas (.430 to .480); then there are coal gases corresponding very nearly or quite to the cannel gas of London, with a comparatively low specific gravity and high illuminating power, like the Manhattan (illuminating power 17 to 18.50 candles by Sugg-Letheby burner, and specific gravity .450 to .500); and lastly, those gases enriched with

naphtha having a high specific gravity (.650 to .750) and high illuminating power. Up to the present time I have limited my experiments more especially to the first class or common coal gases, as to this class belong the majority of illuminating gases of this country. Perhaps the average gas is more nearly equal to the English coal gas—from 14 to 16 candles illuminating power. For gases of this nature undoubtedly the best results can be obtained with Sugg's London Argand, adopted by the Gas Referees. It is provided with a chimney, 6″×1⅝″ for 14-candle gas, and another 6″×1⅞″ for 16-candle gas.

Gases which test from 16 to 17 candles by the Sugg-Letheby burner cannot be tested by the Referees' burner without some loss, as in every case I have tried, the flame tailed over the chimney. Tests were made with the Referees' burner and a chimney 7″×1⅞″, and good results were obtained; but, as will be seen later on, the maximum of light was not reached.

Experiments were made with Sugg's "E," "F," and "G" burners. Excellent results were obtained with the "E" burner, but with burners "F" and "G" the gas was undoubtedly overburned, for the illuminating power was below that of the "E." It is to be borne in mind that these burners are designed for a certain consumption of gas (the "E" for 5½ cubic feet; the "F" for 6¼ cubic feet; and the "G" for 7 cubic feet per hour), and it is hardly to be expected that they would give the best results when burning smaller quantities.

The following table shows some of the results obtained. Other experiments are in progress. The gas used in the testings was that of the New York Company.

The results given are the average of a large number of tests. The pressure of the gas as delivered to the burner varied from .15 inch to .30 inch, according as the bushing affixed to most of the burners was left in place or removed. In all cases, however, the pressure was reduced to a minimum consistent with an easy flow of gas. The tests were made with an hourly consumption of gas of five cubic feet, no matter what the capacity of the burner—

Burner.	Dimensions of chimney in inches.	Illuminating Power.	Illuminating Power by Sugg-L'thby burner.	Difference candles.
First Series.				
Sugg's London Argand, No 1	$6x1\frac{7}{8}$	16.83	15.95	.88 tailed
" " "	$7x1\frac{7}{8}$	17.02	15.95	1.07
"E" Burner	$7x1\frac{5}{8}$	17.60	15.95	1.65
"F" Burner	$7x1\frac{5}{8}$	17.40	15.95	1.45
"G" Burner	$8x1\frac{7}{8}$	17.28	15.95	1.33
Second Series.				
Sugg's London Argand, No 1	$6x1\frac{7}{8}$	16.38	15.64	0.74 tailed
" " "	$7x1\frac{7}{8}$	17.16	15.64	1.55
Third Series.				
Sugg's London Argand, No 1	$6x1\frac{7}{8}$	Smoked.	16.22	——
" " "	$7x1\frac{7}{8}$	17.28	16.22	1.06
"E" Burner	$7x1\frac{5}{8}$	17.80	16.22	1.58
" "	$7x1\frac{7}{8}$	17.20	16.22	0.98

From these tests it will be seen—

1st. That Sugg's London Argand No. 1, with a $6'' \times 1\frac{7}{8}''$ chimney, gave from .7 to .9 of a candle more than the Sugg-Letheby. This is low on account of the tailing of the flame.

2d. That the same burner with a $7'' \times 1\frac{7}{8}''$ chimney, gave from 1.1 to 1.5 candles more than the Sugg-Letheby.

3d. That Sugg's "E" burner with a $7'' \times 1\frac{5}{8}''$ chimney, gave from 1.58 to 1.65 candles more than the Sugg-Letheby, while with a $7'' \times 1\frac{7}{8}''$ chimney the difference is equal to about 1 candle.

4th. That burners "F" and "G" gave from 1.4 to 1.3 candles more than the Sugg-Letheby.

5th. That with a gas of 15.50 candles, by the Sugg-Letheby burner most excellent results are obtained, by Sugg's London Argand No. 1, with a chimney $7'' \times 1\frac{7}{8}''$.

6th. That the Sugg-Letheby burner gives results about 1.5 candles below the burner giving the best results.

As to a suitable burner for rich coal gases and naphtha gases, I am convinced from a number of experiments, that the burner which gives the best results with a rich coal gas will not burn the naphtha gases to the best advantage. A 5-foot batwing is used in testing London cannel gas (23c. to 28c.), the gas of Glasgow, (28c. to 30c.) and in other places. While this burner gives good results with rich coal gas, it is not suited to naphtha gas. A naphtha gas requires a flat flame burner, the same as a rich coal gas, but one in which the slit is much narrower, so that the gas may be spread and a more intimate contact with the air offered. At the same time such a burner would over-burn rich coal gas. The simple matter of candle power is not the only element to be considered; the higher specific gravity of the naphtha gases is also to be taken into consideration.

Experiments on this point are in progress, and their results, together with the relations existing between the different burners, Sugg's illuminating power meter, and the jet photometer, will form the subject of another paper.

CAPT. WHITE—I move that a vote of thanks be tendered by the Association to Dr. Love for his exceedingly interesting and valuable paper.

Carried.

THE PRESIDENT—The subject of Dr. Love's paper is now open for discussion.

MR. HARBISON—It was decided this morning that the next annual meeting of our Association should be held at Chicago. I am not aware that there has been any committee of arrangements appointed.

THE PRESIDENT—I will do it now. I appoint Mr. Watkins, President of the Chicago Gas Company; Mr. Henry, a lawyer, also connected with the Gas Company there; and Mr. Thomas Butterworth, of Rockford, Ill.

MR. HARBISON—I move that the name of the Secretary of the Association, Capt. White, be added

Carried.

MR. HARBISON—I would like to make a suggestion to the

committee just appointed. I trust that some place will be selected in Chicago for holding our meeting, where we will not suffer as we have in this and other places. It is exceedingly annoying to the members of the Association, as well as to the presiding officer, to be obliged to submit to the noise that is continually made by the moving of the chairs and the feet upon the bare floor. Every movement is heard. No one can come in or go out or change his seat without creating a great deal of noise and disturbance. I trust that the place of meeting next year will be free from this cause of complaint, and I hope the committee will be able to secure a room that has a carpet on the floor, so that we may have silence.

The President—Mr. Burtis, you hear the suggestion from Mr. Harbison, and you can communicate with Mr. Watkins upon the subject. The matter of standard burners is now open for examination and discussion.

The Secretary—Gentlemen of the Association : In a conversation with Dr. Love, which led to the paper being prepared to which you have just listened, and which contains suggestions and facts so interesting and so valuable, several thoughts occurred to me which I believed might be developed in a paper, and which would be of benefit to the members of the Association, to gas men, and to the public throughout the country. One thought that presented itself to my mind was whether or not a standard burner, or burners, might not be established by the action of the Association, and adopted and used by the different companies throughout the country in fixing a standard by which to measure the gas made, so that the companies would be able to make comparisons with each other, and understand each other when the subject of candle power was discussed. A further thought suggested itself to my mind, and it was this : The gas interests of the country are, at some time, to be the subject of legislation, beyond all question ; and if the gas interest of the country could present to the different legislatures and legislators, an intelligent knowledge of the conditions necessary to a fair development and a fair standard of the gas made, they might have something in their own hands to guide that legislation, in the future to a large extent, and to

relieve themselves, perhaps, from more or less oppression, by taking the initiative and acquainting the public and themselves as to what is necessary for a fair and just standard between themselves and the public. From the paper which has been read by Dr. Love I see that his opinion is that no one standard can be made, and no one burner can be used ; but a series of burners might be used, or some plan be developed by inquiry and investigation by which a standard burner for a 14-candle gas may have one kind of chimney attached to it, and another burner for a 16-candle gas have another chimney attached to it ; and so going through with the different qualities and kinds of gas. In this way you will be able intelligently to talk with each other and understand what each means, when you speak of the respective candle power of the gas you make.

These are simply suggestions which have presented themselves to my mind in relation to the matter, and I would like very much to hear what other gentlemen think about it, and whether it is worth while to appoint a committee to investigate that subject and report at a future meeting. If we are going to make gas for twenty years longer, as Mr. Page thinks we are, I think it is very important that we should have the best burners, and have, if possible, a plan by which a standard can be arrived at.

Mr. Littlehales—This question of burners being under discussion, I think it will not be out of place for me to make a few suggestions as to the desirability of gas companies, or the managers of gas works, taking a little more interest than is often done in the burners used by consumers. There is no doubt that a great deal of dissatisfaction is caused in the minds of consumers because they do not get good burners. Now, our company has for some time past been getting the best burners they could—not the highest-priced burners, of course, but such burners as our customers can afford to pay for. We sell them at cost price, and I believe it would pay every gas company to adopt that plan. Of one thing I am sure, and that is, that it would be to the interest of gas companies to look into this matter and see what can be done in the direction of furnishing good burners at a reasonable price to consumers.

It very often happens when complaints in regard to poor gas are made, that investigation discloses the fact that the burners are poor, and that a change of burners often remedies the difficulty. Of course, the companies will not seek to make any profit out of the sale of burners, but will furnish them at cost price.

MR. STARR—I have been doing that for the last four years; I give away burners; I never charge for burners furnished my consumers. I have furnished about 100 gross to customers. We try to get the best burners. Another thing that I do in putting the burners in, is to regulate the size of the burners used in the different parts of the house. For instance, where there are bedrooms I recommend the use of a smaller burner, and in a sitting room, where a great deal of light is required, I recommend larger burners. I find that this system has worked well with us.

MR. SHERMAN—I hope the suggestion that Mr. Nettleton has made in regard to standard burners will be carried out by this Association. I think a committee ought to be appointed to examine into this question. There is a great deal of ignorance in the community, in regard to this matter of burners particularly. Every time the Legislature comes together it is with fear and trembling on the part of the gas companies. We are liable constantly to hostile legislation; and I have frequently seen men who were unfriendly to gas companies go around and canvass the members of the Legislature, in order to get some provision of law in regard to the use of a test burner which would reduce the quality of the gas three or four candles. I therefore move, Mr. President, that a committee be appointed by the chair to investigate this subject of standard gas burners; and to ascertain, if possible, which would be the best burner to be adopted by all the companies.

Carried.

THE PRESIDENT—I appoint Mr. Nettleton, Mr. Sherman and Major Dresser as a committee.

MR. HARBISON—There is another matter that I for one should be glad to hear discussed before this meeting of the Association is closed. It is now getting late in the day, and it

being the last day, this would seem to be the best opportunity for the expression of opinion on the part of the members in relation to heating and cooking by the use of gas stoves. I have been talking with a man who knows something about it and has had some experience. I understand that Mr. Goodwin, a member of the Association, and who is a manufacturer of gas stoves, has made some very important experiments, by way of comparison, between cooking by gas and by anthracite coal. I think the result of his experiments will be exceedingly interesting and instructive to us; and I move, Mr. President, that Mr. Goodwin be requested to favor the Association with the results of the experiments he has made.

Carried.

CAPTAIN WHITE—Mr. President, the committee are ready to report upon deceased members; and, with your permission, I will now present that report. The committee to whom was referred the work of preparing resolutions upon deceased members of the Association beg leave to report that they are informed that there has been but one death during the current year—that of Wm. B. Clelland, for many years Secretary and Superintendent of the Vicksburg, Mississippi, Gas Light Company. Your committee submit the following:

The American Gas Light Association, holding its Seventh Annual Session in Philadelphia, during October, 1879, learns with sincere regret that it has been called upon to mourn the loss of another of its active members, and to add to the sadly lengthening roll of deceased members the name of

MR. WM. B. CLELLAND,

who was for many years the efficient manager of the Vicksburg Gas Light Company, of Mississippi, and departed this life October 10, 1878, a victim of the yellow fever.

While the Association could not hope to escape the sad affliction laid upon so many of our citizens during the terrible epidemic of 1878, it may console itself in the knowledge that the one who dropped from our ranks died at the post of duty, and sacrificed his life to what he deemed the manliest course.

The Association expresses to the family of Mr. Clelland its

sincere condolence, and feels that the vacancy thus made in his family circle and business relations will be irreparable.

WM. HENRY WHITE,
G. WARREN DRESSER,
Committee.

The committee also desire to offer a resolution that this report of the committee be engrossed and sent to the family of the deceased, and to the company with which our deceased associate served.

On motion the report was accepted and adopted, and the resolution passed.

Mr. Goodwin then read his paper as follows:

THE ECONOMY OF GAS AS A FUEL FOR COOKING PURPOSES.*

MR. PRESIDENT AND GENTLEMEN OF THE ASSOCIATION: I have not prepared a regular paper to be read, but I have a statement of facts—the results of some experiments in cooking—which I will present to the Association without comment. I have also prepared a tabulated record of tests made by boiling a given quantity of water over a flame composed of different portions of gas and air under varying conditions, in order to determine which was the best quantity of air to introduce with gas to secure the most favorable results.

My standard was 8 pounds of water. The gas was consumed at the rate of 10 feet per hour; the time required to raise 8 pounds of water from 73° to the boiling point was 28½ minutes, consuming 4.466 feet of coal gas. I would say here that I designed an apparatus for furnishing air in a measured quantity, and mixing it with the gas before burning. That apparatus is so arranged that the gas and the air can be put into the burner in their normal condition, or the gas and the air can be heated both together or separately.

In the first test the gas was cold and the temperature of the water was 77⅓° F.

Tabular Record of Tests on Boiling Water over a Flame composed of Different Proportions of Gas and Air, under Different conditions—Coal Gas, 16½-Candle Power. Weight of Water, 8 pounds.

	No. Trial.	Temp. of Water.	Increase of Temp.	Time Required.	Gas Consumed.	Per Cent Less Time.	Per cent Less Gas.
		Degrees.	Degrees.	Minutes.	Feet.		
Test No. 1—Pure gas at the rate of 10ft. per hour	1	70	132	28.5	4.5		
	2	76	136	28.5	4.4		
	3	76	136	28.5	4.5		
	Av.,	77⅓	134⅔	28.5	4.466		
Test No. 2—1 volume of gas and 1 of air.	1	80	132	22.5	3.6		
	2	74	138	23	3.6		
	3	74	138	23	3.6		
	Av.,	76	136	22.83	3.6	20	19
Test No. 3—1½ volumes of air to 1 of gas.	1	78	134	22	3.4		
	2	76	136	22.25	3.5		
	3	76	136	22	3.5		
	Av.,	76.6	135.3	22.08	3.46	22.5	22
Test No. 4—2 volumes of air to 1 of gas.	1	79	133	21	3.3		
	2	76	136	21.5	3.4		
	3	76	136	21.5	3.4		
	Av.,	77	135	21.3	3.32	25	25.5
Test No. 5—2 1-6 volumes of air to 1 of gas.	1	71	141	21.25	3.3		
	2	74	138	22	3.5		
	3	76	136	21	3.2		
	Av.,	73.66	138.3	21.4	3.3	26	26.1
Test No. 6—2 1-6 volumes of cold air to 1 of heated gas.	1	73	139	28	4.1		
	2	74	138	26	3.8		
	3	74	138	27	3.9		
	Av.,	73.66	138.33	27	3.93	5.2	11
Test No. 7—2 1-6 vols. of heated air to 1 of heated gas.	1	74	138	27	4.0		
	2	74	138	26.5	3.9		
	3	74	138	26.75	3.9		
	Av.,	74	138	26.75	3.93	6	11
Test No. 8—2 1-6 vols. of heated air to 1 of cold gas.	1	74	138	26.5	3.9		
	2	75	137	26.25	3.8		
	3	76	136	26	3.8		
	Av.,	75	137	26.25	3.83	7.8	12

After determining the quantity of coal gas required to boil 8 pounds of water, I mixed various quantities of air with the gas, and obtained the following results, each test named being an average obtained from three trials, viz.:

In the second test 8 pounds of water were used and one volume of air and volume of gas. The quantity of gas consumed was 3.6 feet. In that case the boiling point was reached in 22.83 minutes, being 20 per cent less time required and 19 per cent. less gas than in test No. 1.

The third test was 1½ volumes of air, 1 volume of gas, and the same quantity of water. Time, 22.08 minutes; gas consumed, 3.46 feet, or 22½ per cent less time and 22 per cent less gas than in the first test.

The fourth test was 2 volumes of air and 1 of gas. Time, 21.3 minutes; gas consumed, 3.32 feet; or 25 per cent. less time and 25½ per cent less gas required than in the first test.

The fifth test was $2\frac{1}{6}$ volumes of air and 1 of gas. I will state that I found the best results were obtained with this mixture. It has been found, in Europe, that $2\frac{1}{3}$ volumes produce the most favorable results. The candle power of the gas has something to do with it, I presume. This is certainly a very close comparison. In this test the quantity of gas consumed was 3.3 feet; the time occupied was 21.4 minutes; or 26 per cent less time and 26.1 per cent less gas required than in the first test.

In the sixth test the gas was heated, and the time went up to 27 minutes; quantity of gas consumed, 3.92 feet; reducing the time to 5.2 and the gas to 11 per cent.

The seventh test was heated gas and heated air. The time required was 26¾ minutes; quantity of gas consumed, 3.93 feet; or 6 per cent less time and 11 per cent less gas.

The eighth test was heated air and cold gas. Time, 26¼ minutes; consumption of gas, 3.83 feet; or 7.08 per cent less time and 12 per cent. less gas.

In tests Nos. 6, 7 and 8, the air and gas were heated separately in coils of copper pipe over separate flames, arranged so that the air or the gas could pass through the coils or not, as was desired. Each of these coils had a heating surface of 472

square inches, and in the tests the tubes were heated to redness. The conclusion is that the best condition for burning gas, according to these tests, is—2½ volumes of air and 1 volume of gas, and both of them in their normal condition, or cold.

Cooking Test.—Made between a No. 8 Peerless Range and a No. 7 Sun-Dial Gas Stove.

I have also copies of tests that were very carefully made a few days ago—made as carefully as I knew how to make them, of the difference in cooking between a regular range and a No. 7 gas stove. The articles cooked were twelve in number, and were cooked so that they were all ready to place upon the table at once.

The range used was a No. 8 Peerless Range. The articles were weighed before cooking, and also after cooking, and the percentage of loss in weight and the time required were carefully ascertained. For instance, a 3-pound bluefish weighed 2 pounds and one ounce after cooking in the range—being a loss of 32 per cent; time, 31 minutes. In the case of the gas stove it weighed, after cooking, 2 pounds 6 ounces. To be more explicit, I took two bluefish, each weighing 3 pounds, and cooked one in the range and one in the gas stove, with the results I state. The time required for the cooking of the fish in the gas stove was 35 minutes, 4 longer than the time required for cooking it in the range. The loss was 20 per cent, or a saving of 12 per cent. in favor of the gas stove.

A rib of beef weighing 9 pounds 7 ounces, weighed 6 pounds 8 ounces when cooked in the range; a loss of 32 per cent; the time was 1 hour and 37 minutes. In the gas stove the time was 1 hour and 25 minutes; loss, 17 per cent.

To show how close these tests are with some made in England, I will state that the average was found to be 33 per cent loss in cooking in the ordinary way, and 15 per cent on the gas stove. My tests show a loss of 32 per cent. on the range and 17 per cent on the gas stove—another very close comparison. A 3 pound and one ounce chicken, cooked in the range, weighed 2 pounds and 2 ounces when cooked; loss, 30 per

cent; the time was 1 hour and 6 minutes. In the gas stove, time, 1 hour; weight when cooked, 2 pounds, 10 ounces; loss, 14 per cent. A 1 pound 2 ounce beefsteak weighed, when cooked in the range, 13½ ounces; loss, 25 per cent.; time, 11 minutes. An equal weight of beefsteak cooked in the gas stove weighed when cooked 15 ounces; time, 8 minutes; loss, 16⅔ per cent. Each of these articles as I have said, was weighed carefully before cooking, and was weighed immediately after being brought out of the stove or range. Lamb chops weighing 1 pound and 1 ounce, weighed 11 ounces after being cooked in the range; a loss of 35 per cent.; time, 12 minutes. In gas stove, an equal weight of lamb chops, after cooking, weighed, 13½ ounces; time, 10 minutes; loss, 15 per cent. There was also in each case 3 pounds and 5 ounces of sweet potatoes, 3 pounds and 8 ounces of white potatoes, 3 pounds and 12 ounces of cauliflower, and 4 pounds of tomatoes. These articles were all cooked in a steamer. Bread baked in the range, 5 pounds and 2 ounces, in 46 minutes; in the gas stove, 37 minutes. Sago pudding, 3 pounds 5 ounces, 27 minutes in the range; in the gas stove, 28 minutes. Lemon pie, 2 pounds 14 ounces, 30 minutes in the range; on the gas stove, 22 minutes. In these articles no change of weight was noted. There were also prepared, sauces for the fish, the beef and the cauliflower. The total time from the lighting of the fire in the range until everything was ready to serve was 2 hours and 40 minutes. Of this time 30 minutes were required to heat the oven, leaving 2 hours and 10 minutes as the actual cooking time. The weight of the coal, including the lighting of the fire, was 44 pounds. At the end of that time the fire was ready for more coal. The 44 pounds of coal, $5.50 per ton, cost 10.95 cents, the kindling wood, one cent, making a total of 11.95 cents.

Gas Stove.

The total time from lighting the gas until everything was ready to serve on the table was one hour and fifty minutes; the consumption of gas, by a test meter, was 38 feet. At the price of $2.15 the gas cost 8.17 cents, against 11.95 cents in the case of the range. The gas was lighted in the roasting

chamber at 11 o'clock; 4 minutes after lighting, the beef and chicken were put in the roasting chamber; at 7 minutes past 11, the bread was put in the oven on the lower shelf; at 10 minutes past 11, the pie was put in on the upper shelf; at 16 minutes past 11, the water was put in the steamer cold, for cooking the vegetables; at 25 minutes past 11 the vegetables were put in, the cauliflower being at the bottom of the steamer, and the potatoes on the shelves; this steamer was over one of the burners of the hot plate, the other being used to stew the tomatoes and make the sauces. After the pie was baked, the pudding was put in on the lower shelf, the bread was removed to the upper shelf to brown on top; after the bread was baked the fish was put in the oven. After the meat and chicken were roasted the steak and chops were broiled. You will observe that so far as the actual cost or expenditure for fuel is concerned—and that, it seems to me, is one of the points that we are considering—the comparison is as 8.17 cents is to 11.95 cents. But there is another very important question connected with these tests, and that is the comparison in the percentage of loss in the food that was cooked in the range as against that cooked on the gas stove. The cost of the fish was 35 cents. It showed on the range a loss of 10¼ cents; on the gas stove it showed a loss of 6½ cents, consequently there was a saving in the weight of fish as between 6½ cts. and 10¼ cts.—a saving of 3¾ cts. on the weight of the fish. The beef cost $1.69. After it was cooked on the range it was worth $1.17 cents, showing a loss of 42⅞ cents. On the gas stove the loss was 28⅛ cents, or a saving in favor of the gas stove over the range of 14¾ cents. The loss in the weight of the chicken was 17½ cents; in the gas stove it was 8¾ cents; showing a saving over the range of 8¾ cents. The steak lost 6 3/16 cents in the range, and 4⅛ cents in the gas stove—a saving of 2 1/16 cents. The loss on the chops was 7½ cents in the range, and 3⅛ on the gas stove—a saving of 4⅜ cents. The total saving of the gas stove over the range; in food lost, was 33 11/16 cents. These are the facts. [Applause.]

The following are the foregoing facts, in tabular form, arranged for comparison :

Record of Peerless Range No. 8.

ARTICLE.	How Cooked.	WEIGHT.				Loss Per ct.	Time.	
		Before Cooking.		After Cooking.				
		lbs.	oz.	lbs.	oz.		h.	m.
Bluefish	Baked	3	0	2	1	32	0	31
Rib of Beef.....	Roasted.	9	7	6	8	32	1	37
Chicken	Roasted.	3	0	2	2	30	1	6
Beefsteak	Broiled.	1	2	0	13½	25	0	11
Lamb Chops....	Broiled.	1	1	0	11	35	0	12
Sweet Potatoes	Steamed.	3	5					
White Potatoes	Steamed.	3	8					
Cauliflower	Boiled.	3	12					
Tomatoes	Stewed.	4	0					
Bread	Baked.			5	2		0	46
Sago Pudding..	Baked.			3	5		0	27
Lemon Pie......	Baked.			2	12		0	30
Sauces for fish beef & caulifl'r								

Total time from lighting of fire until everything was ready to serve, 2 hours and 40 minutes. Of this time 30 minutes were required to heat the oven, leaving 2 hours and 10 minutes actual cooking time. Weight of coal, including lighting of fire, 44 lbs. At the end of the time the fire was ready for more coal. Cost of coal, 44 lbs., at $5.50 per ton, 10.95 cents. Kindling 1 cent. Total, 11.95 cents.

Record of No. 7 Gas Stove.

ARTICLE.	How Cooked.	WEIGHT.				Loss Per ct.	Time.	
		Before Cooking.		After Cooking.				
		lbs.	oz.	lbs.	oz.		h.	m.
Bluefish	Baked.	3	0	2	6	20	0	35
Rib of Beef........	Roasted.	9	4	7	11	17	1	25
Chicken	Roasted.	3	1	2	10	14	1	0
Beefsteak	Broiled.	1	2	0	15	16⅔	0	8
Lamb Chops........	Broiled.	1	0	0	13½	15	0	10
Sweet Potatoes......	Steamed.	3	5					
White Potatoes......	Steamed.	3	8					
Tomatoes	Stewed.	4	0					
Cauliflower.	Boiled.	3	12					
Bread	Baked.			5	7		0	37
Sago Pudding	Baked.			3	3		0	28
Lemon Pie	Baked.			2	14		0	22
Sauces for fish, beef, and cauliflower.								

Total time from lighting of gas until everything was ready to serve, 1 hour 50 minutes. Consumption of gas by test meter, 38 feet. At $2.15 per thousand feet, cost, 8.17 cents.

Table of Comparison of Percentages in Loss after Cooking.

	Gas Stove.		Range.	
Fish....	Cost,	35 c.	Cost,	35 c.
	Product,	28½c.	Product,	24¾c.
	Loss,	6½c.	Loss,	10¼c.

Saving of gas stove over range, 3¾ cents.

Beef....	Cost,	166½c.	Cost,	169⅞c.
	Product,	138⅜c.	Product,	117 c.
	Loss,	28½c.	Loss,	42⅞c.

Saving of gas stove over range, 14¾ cents.

Chicken.	Cost,	61¼c.	Cost,	60 c.
	Product,	52½c.	Product,	42½c.
	Loss,	8¾c.	Loss,	17½c.

Saving of gas stove over range, 8¾ cents.

Steak ..	Cost,	24¾c.	Cost,	24¾c.
	Product,	20⅝c.	Product,	18 9/16c.
	Loss,	4⅛c.	Loss,	6 3-16c.

Saving of gas stove over range, 2 1-16 cents.

Chops ..	Cost,	20 c.	Cost,	21¼c.
	Product,	16⅞c.	Product,	13¾c.
	Loss,	3⅛c.	Loss,	7½c.

Saving of gas stove over range, 4⅜ cents.

Total saving, 33 11-16 cents.

Mr. Harbison—I have listened with the greatest interest to the statement which Mr. Goodwin has just made. I think it has really been of more value than any other subject that has come up during the meeting. We have got here some practical information, and it seems to me that every engineer and every man connected with gas works who desires to increase his con-

sumption should give the most careful attention to the subject that has been presented in so interesting a manner by Mr. Goodwin. I think, Mr. President, it would be well if we could get this statement from Mr. Goodwin in such a form as that it could be printed and distributed; and I think if we can do that it would be better to pass a resolution directing that a certain number of copies be printed and distributed among the members of the Association, then each of us can personally take such action as we think best. I think it would be well for the Association to print 500 copies, and for each member to have two copies of this valuable information; then each of us can make such tests and ascertain such results as he feels disposed. I therefore move, Mr. President, that the Secretary be requested to obtain this statement of facts from Mr. Goodwin, and that it be published at an early day, and two copies be distributed to each member.

Carried.

MR. GOODWIN—I have simply given you the figures. I do not propose to comment upon them at all.

MR. HARBISON—I did not mean by anything I said to advertise the Sun Dial Gas Stove, or any other article manufactured by Mr. Goodwin's house. I do not mean for one moment to be understood as an advocate of any particular kind of stove; but what I say is that the statement made by Mr. Goodwin is a very valuable one, and I think it contains information which is of the greatest value to every member of this Association who has anything to do in the management of gas companies, and who desires to find means to increase his consumption; and my object in making the motion that I did, was to provide some means of distributing this information in a printed form among the members, so that we might have an opportunity of pursuing the subject further if we so desire.

MR. HELME—There is a gentleman present who has also been experimenting in that direction, and I think he will be able to give us some facts of interest on the subject. I refer to Mr. Hawley.

MR. HAWLEY—I shall be very happy to give the Association such information as I can in regard to this subject; but I shall

confine myself to a practical view of it. What all of us who are interested in this subject want to know is how the gas companies can encourage heating and cooking by gas, and the best manner in which to extend the use and sale of their gas for that purpose.

I assume, for the purpose of what I have to say, that there is a great field open for gas companies to occupy, and that is the promotion of heating and cooking by gas. I have had some considerable experience in this matter, and have had an opportunity of witnessing the practical working of gas stoves. In small houses, where the wife has to do all the cooking, and in boarding houses or small rooms, where persons prefer to cook for themselves, there is a great field for a good gas stove, that is, so far as cooking is concerned. I think, before I finish these remarks, I will convince the members of the Association that for heating purposes there is an equally wide field for a gas stove. I mean in the way of heating bath-rooms, or butler's pantries, or hall bedrooms. I will venture to say that in the territory of almost any gas manager, and especially those who are located in large cities and towns, there are a large number of houses where there is either a bath-room, or a butler's pantry, or a hall bedroom, or some place of that kind, where a gas stove for intermittent use would please the people, and could be easily introduced. I think, also, you will agree with me, before I have closed, that there is also a wide field for the use of gas for heating purposes in our hotels. You go to a hotel now and ask for a fire, and you are charged 50 cents or $1.00 for it. It is a great nuisance, and dirties up the room, and every time the fire is mended or replenished the coal dust and ashes are deposited everywhere. Now, a gas stove that would not vitiate the air could be put into hotels, in the smaller rooms, and, with gas at $2 per thousand, they would not cost more than 23 cents, even if the occupant of the room burned the gas all night, and it would not cost as much as it would for the coal fire.

This being so, the question arises, if these stoves are so convenient and so inexpensive, why do the public not take them? I will endeavor to answer that. The public will certainly

take them if they are introduced in the right way. An evidence that such an article is just what is needed is found in the fact that there are millions of oil stoves in use in the United States to-day, for cooking purposes in the summer time, and for heating small rooms. They are not found in great houses; but for small rooms and apartments they are in great demand. We all know what an unpleasant smell there is about them, and how great a nuisance they are. This being so, why are they so extensively used? It is because the desire to get rid of the range in summer time is very great; and because there is such a natural demand for some article of this kind, that will heat small rooms. Again, there is prejudice against using gas for this purpose. Why? In the first place, if you will allow me to say so, gas companies are very indifferent about this matter. They have not endeavored to assist the public in adopting them at all.

In many cases, that I have heard where the gas bill was large, the company would ask the consumer, "Haven't you a gas stove?" "Yes." "Oh, well, that explains it all. You must not talk about a large bill if you have a gas stove!" That sort of reply answers the purpose, but it creates a prejudice against the use of gas for cooking or heating purposes which is very hard to overcome. Again, the fact that there is so much uncertainty in the use of gas for heating and cooking purposes is another element that goes toward creating a prejudice in the minds of the public. The public are not allowed to make experiments for their own interest, and the result is they are very slow to take hold of the matter. And the prejudice which exists for the reasons I have already stated is an obstacle which has to be met and overcome at the outset.

Again, the general impression is that a gas stove cannot be used in a close room. That was true at one time, but now it is not true.

I come now to my first point, which is that private parties cannot supply want. No private party can afford to go into the market and fight down this prejudice and build up a business. I do not believe that the gas stove could ever be introduced if it depended upon private enterprise.

Now, have gas companies any interest in this matter? Consult your own common sense. The public will not buy the stoves, on account of the prejudice I have spoken of. How are we to overcome this prejudice? Why, we must introduce the stove ourselves. I have collected some statistics in regard to this matter, and I think that I shall be able to show you that the furnishing of these stoves by the gas companies is the very best investment they can make. I submitted these statistics to the board of directors of our company some time ago, and stated my views upon the subject; and they were very much in favor of it. They passed a resolution to introduce gas stoves free of cost. We had one in operation in our office, and we invited our consumers to call and examine it for them selves; and we told them we would charge them nothing for furnishing the stove and putting it up except for the furniture. A circular was sent out to our consumers stating these facts, and a great many ladies and gentlemen came to see the stove in operation. They were delighted with it, and it was on the high tide of success. A great many said they wanted the stove put up right away. I told them we would put them up without cost except that they would have to buy the furniture. They would inquire almost invariably if we did not furnish the furniture with the stove. We told them no; that the furniture would cost some $3 or $4. A good many declined on that account to have them put up, who would otherwise have done so. If we had had foreknowledge enough to have gone one step further, and furnished the whole thing, we would have been able to put up a good many more stoves than we did. As it was, however, we put up a great many in our territory, and they gave great satisfaction. That was the blunder we made; but it taught me this, that private parties will not spend the money to buy these gas stoves, and that is for the interest of the gas companies to furnish them. They ought to send around to their consumers word that they will put up these stoves and furnish everything. I omitted to say that we charged a rent of 12 cents a month, and we told our consumers in every case that if they did not like it we would take them down. In not a single instance did our consumers have the

stoves taken down. I think we ought to make this a department of our business. We should furnish these stoves, with everything belonging to them, to our consumers, put them up without cost, and charge them nothing except a merely nominal rent. Let me show you what an investment it is. These stoves cost from $10 to $25. The highest-priced stove, one by which you can cook, and wash clothes, and everything of that kind, costs $25; but the ordinary stove, such as we would want to put up, would cost, I suppose, about $10. The time for cooking has passed, but the season for heating has just begun. Let me bring this matter before you practically. Suppose that we have a gas stove that costs $5. Suppose that the putting up and the tubing cost 90 cents. There is a cost of $5.90, or, say, $6 ; the interest on that per year, at 6 per cent, is 36 cents. A gas stove will last a long time. For six months you get 75 cents for the stove, or $1.50 a year. There is no way in which money can be invested that will bring in such an interest as that. We will suppose that the gas stove to be put up in hall bedrooms, and in bath-rooms, where it will not be so very much used; but even if it is not used very much you have an interest on your investment a great deal larger than is afforded by any other industry in this country. If you will figure this up for yourselves you will see that you can make 30 or 40 per cent on your investment. These figures are upon the supposition that gas is used for heating alone; but suppose it is also used for cooking. The cooking season, it is true, has passed; but where these stoves are put up for heating purposes, at this season of the year, they will prove so satisfactory, their use for cooking purposes will be continued. Suppose that you have four or five hundred stoves that you have put up at this season for heating purposes, it is no trouble, in anything like a large town, to introduce as many as that upon the plan that I have spoken of. When the next spring comes you have three hundred or five hundred consumers using these gas stoves. You have broken the ice; you have aroused the public attention; you have excited public interest, and it is more than probable, when the spring comes, those who have been using the stoves for heating rooms in the

winter will use them for cooking stoves in the summer. They will be found to be so convenient for this purpose, that their introduction cannot but be extended; and thus, gradually, you will get them among the greater portion of your consumers. The prejudice in the community will be overcome, and the gas stove will be a substantial success.

Much that Mr. Goodwin has said I agree with. So far as my experience goes, burning gas with air previously mixed is a great mistake. In the first place, that is the reason why gas stoves are so injurious to health. They generate so much carbonic oxide. We all know the effect upon human life of carbonic oxide. If you will turn back to the *American Gas Light Journal* of February 2d, 1877, you will see the result of some experiments that were made in this direction. Three pigeons were put in a bath-room where the gas had been burning for an hour. One was put at a height of a man's head, another about half-way between that and the floor, and another on the floor. In ten minutes time the pigeon that was on the wall was down in the corner greatly distressed, and in twenty minutes it was dead. The pigeon that was next below was down on the floor dead in thirty minutes. The pigeon on the floor lived five hours. They took him out at the end of that time, and put him in a cage, and he immediately died. Now, that atmosphere is not the kind of atmosphere that we want in our hall bedrooms and in our bath-rooms. I am prepared to prove that mixing air and gas previous to combustion, is not the right thing to do. I can get better results by superheating the gas, and superheating the air, and mixing them, than I can in any other way. I have got the statistics upon this subject, and shall be glad to furnish them to those who desire them. I have made a great variety of experiments in a great variety of forms, and I think I have reached some pretty satisfactory conclusions. One thing I am thoroughly convinced of, and that is, that gas companies can add an immense percentage to their business if they will have energy and enterprise enough to furnish the capital and supply gas stoves to their customers, as I have suggested. If they do so they will find that their consumption will be very largely increased, and that it will be a great investment for their money.

Mr. Allen—I would like to ask one question, and that is, if Mr. Hawley tried how long a pigeon would live in coal gas? He has tried how long it would live in carbonic oxide and water gas.

Mr. Littlehales—He says he was burning coal gas under a blue flame which produced carbonic oxide. He didn't say that he used water gas.

Mr. Allen—I think that he is entirely mistaken in relation to it.

Mr. Hawley—You are under the impression that I said the pigeons were put under the influence of water gas. I said it was carbonic oxide. I said, that if you will look at the *American Gas Light Journal*, under date of February 2d, 1877, you will find the facts which I have given. I said that carbonic oxide was generated when coal gas was previously mixed with air before it issued from the burner. The fact is that the air is cold, and it takes just so much of that fuel to heat the air, and it takes a large amount of fuel to overcome it.

Mr. Allen—While we are talking on the gas stove subject I will state that I have one in my kitchen at Poughkeepsie, burning gas made on the Allen-Harris process, that we have been running four years and a half, going on five years. I have used no chimney with it; but I think that a chimney ought to be used, because I hold that all combustion should be carried to an outlet. No chimney, however, has been used with this stove, and there is not the least perceptible smell from it in the kitchen, and I heartily indorse everything that Mr. Goodwin says in regard to cooking with it. The water gas has a greater calorific intensity, and it will cook quicker than the ordinary coal gas will. A great many have objections to using gas in stoves because there is not a perfect combustion. That is owing a great deal to the burners. If you have poor burners you cannot get a perfect combustion. But, apart from this, I was going to ask the privilege of saying a word or two upon the subject of water gas; but I will not occupy the time now. I would like, however, if an opportunity offers, to say a few words in reference to the difference between the use of water gas and ordinary coal gas for the purposes that are urged here.

Major Dresser—As the facts seem to be what we want to get at, I will state that I was able to get hold of some facts in regard to gas stoves to-day.

I met a young man on the street and, in the course of conversation, he asked me what we were talking about here. I told him we were talking about gas, and cooking and heating by gas, etc. He said—"The gas stove business is the biggest thing out. Last spring I bought a gas stove. My wife and myself keep house together on a small scale. We have used the gas stove for three months, and my gas bill was $3.83 for the whole time. If I couldn't get another one all the money in Philadelphia wouldn't buy this one from me."

SECOND DAY—Afternoon Session.

Mr. Wood (Syracuse)—I have had a little experience in the use of gas stoves, but I do not believe that the gas stove business can be handled by individuals, but must be handled by gas companies. We arranged for the sale of gas stoves, and give them to our consumers at cost price in our town. We took particular pains, in the first place, to let the people in Syracuse know we had gas stoves by calling their attention to the fact. I invited a party of gentlemen to my office, and brought a caterer there and gave them a good, square meal. The scheme operated very successfully. We gave them a meal in courses—giving them a broiled shad, broiled oysters, broiled steak, roast quarter of lamb, etc. We made gravy, and heated water and washed the dishes four times. Re-setting the table that number of times. As for the economy of them, I agree fully with the figures that Mr. Goodwin has given. I never tried any experiment to know what the cost would be in using coal and giving such a supper. The cost for this supper was 71¼ cents, with gas at $2.50 per thousand. The fish and the meats were cooked extraordinarily well, and everybody was pleased with them. Among the party that night I took particular pains that there should be present an editor of each of our daily, as well as Sunday morning papers. They

gave us a very fine advertisement and local notice in each paper. Simultaneously with that, we prepared an advertisement on the subject and put it in all the papers. We also printed it on the back of our gas bills, and sent them to our consumers, so that the people of Syracuse knew that we had gas stoves to sell.

I do not think there has been anything brought into our community that has attracted so much attention. The people are ready for it. I could not go into the street, and meet friends on business or socially, or even go to church on Sunday, without being asked about that gas stove. There is no trouble in introducing the stove to your consumers, and no trouble in selling the stoves, if you bring them properly before the attention of the people. I have placed these stoves in the best houses in Syracuse, where they have large ranges of the most approved patterns, and the occupants of such houses have told me that they considered them the best article of furniture that was in use in the house, and the most convenient. Many of these people are using them through the winter.

As to the cost of running these stoves, I have not heard the first complaint from any one. We have presented several bills, but no complaint has been brought to my attention in a single instance. I do not quite agree with Mr. Hawley about the profits that gas companies are going to make by putting up these stoves. I think it costs just as much for his plant, and for every item which goes to make up the cost of making gas for cooking purposes as for lighting purposes. I think we should include all the elements of cost in the manufacture of gas, in making it for cooking purposes the same as we do in making it for lighting purposes. I do not know that I have anything more to say upon this subject. There is no trouble in introducing these stoves, in my judgment, if you only let people know that you have got them. If you can once introduce them, of course it will make a very great increase in your consumption of gas. The first stoves we got some time in May or June.

THE SECRETARY—How much has your consumption increased ?

MR. WOOD—We cannot tell. Since the oil excitement has come on, some of our customers have left us and bought oil stoves, and have been burning oil. But they have been coming back ; the oil don't suit them very well. The consumption of gas in these stoves for that reason has been somewhat intermittent, and I am not able to tell what our consumption has been during the whole season.

MR. NEAL—I am informed by the Committee on Arrangements that the use of this hall has been given free to the Association. I would therefore offer a resolution that the Secretary be directed to express our appreciation of the kindness and generosity of the officers of the Franklin Institute in giving us the use of this hall free of charge, and that a vote of thanks be tendered to the officers of the Institute for their courtesy.

Carried.

MR. NEAL—I would like to state, on behalf of the Executive Committee, that since the recess of the Association I have received some applications for membership. As I understand it, the business will be finished and the Association will adjourn at 7 o'clock to-day. It is, therefore, too late for the Executive Committee to take the proper action upon these requests for admission. I am sorry that they were not sent in before. I trust these applications will not fall to the ground, but that they will be presented at our next meeting. I merely state this in order that the gentlemen whose names have been proposed will understand it.

MAJOR DRESSER—On behalf of the Association, I wish to offer the following resolution :

Resolved, That this Association tender to the local committee its thanks for the most admirable manner in which every arrangement for the comfort of the members and the success of this meeting has been made by them.

Carried.

MR. STARR—I understand that the results of the interesting experiments made by Mr. Goodwin are to be published in a separate pamphlet. I think it would now be a good time for the members to come forward and give their orders for

these pamphlets, which are to be given to the people of the community in which they live. I would ask Major Dresser to set me down for 500. I want to distribute them among our people, and if this information is put in tabular form it will save a great deal of trouble.

MAJOR DRESSER—It will save a great deal of expense in the printing of these pamphlets if the members will indicate the number they want.

MR. STARR—If we go in proportion to the size of the town, I suppose Chicago will want 100,000.

MAJOR DRESSER—I an not able to state just what the cost will be, but it will be trifling; and, of course, the greater the number of copies ordered, the less the cost.

MR. STARR—I suppose the statements of Mr. Goodwin will be published in the *Gas Light Journal*, and Major Dresser will then know about what the cost will be, and he can make a statement in the columns of the *Journal* as to what it will be; and members can then send their orders to him by mail for the number of copies they desire.

MAJOR DRESSER—I think that will be the proper course to pursue.

MR. McILLHENNY—I desire to offer a resolution that the thanks of the Association be tendered to our worthy President for the very faithful and efficient manner in which he has performed the arduous duties of his office during this session. All in favor, please say "aye."

Carried.

MR. PRICE—It is very well known that our friend Mr. Allen is here, and would like to make some remarks in regard to his particular system of making water gas, I suppose, or, at any rate, upon the subject of water gas. It is now somewhat late, and I suppose the members of the Association are a little weary; but I will put the question whether they will wait and listen to Mr. Allen or not.

MR. ALLEN—I do not intend to occupy the attention of the Association more than fifteen minutes.

THE PRESIDENT—I think the gentlemen had better wait and listen to what Mr. Allen has to say.

MR. ALLEN—Mr. President and gentlemen of the Association: The manufacture of gas is a science of no mean order, and it seems to me that the scientific principles upon which it is based should be discussed more fully than I have yet heard them.

I have heard a great deal said, and have seen a great deal written, with regard to how impurities in gas should be removed. For instance, I have heard a gseat deal said and have read many articles on the subject of how to avoid the formation of naphthaline, which has been called the curse of gas making for many years. I believe I have never heard the question asked: Can a good illuminating gas he made without the formation of a particle of naphthaline? I have heard the subject discussed in regard to the removal of ammonia. I believe, under the process that has been in operation for seventy-five years, there has never been a gas works that has made gas without making ammonia. The question has not been asked, to my knowledge: "Can gas be made without the production of ammonia?" So with sulphuretted hydrogen and impurities that are formed under the process ordinarily used.

Now there are certain chemical results produced in the manufacture of gas which depend entirely upon the temperatures used. There are two forces that a gas manufacturer employs—expansion and contraction, heat and cold. Without heat there is no light. The impurities in gas are nearly all made at low temperatures. Good gas—perfectly formed chemical gas—is made at a high temperature. Coal tar and oil are distilled, commencing from 793° and running up to 1000°. In the ordinary process you make about 12 gallons of tar per ton of coal.

Now, when your heats are down, ammonia is formed by one equivalent of nitrogen and three of hydrogen, uniting over red heats. If you pursue a process in which your heats are never lowered to red heats, you will have no ammonia.

Naphthaline is formed by a sudden change of temperature. It is a crystalization of the elements subjected to heat. If by

a given process you produce certain proportions of the elements of gas, you will have no naphthaline. It is well known that in the production of illuminating gas there are about 100 simple gases that are combined together and form a compound in which there are 40 hydrocarbons. You have in the ordinary coal gas which you use about 45 per cent of volatile carbons. It requires only about from 7 to 10 per cent. of volatile carbon to make a good 16-candle gas. What becomes of the balance of the carbon? Under the ordinary process of making gas about 45 per cent. is marsh gas or light carburetted hydrogen. Have any of you asked the question why, with this large amount of carbon in the ordinary coal gas, you make 45 per cent of light carburetted hydrogen, that has no more illuminating power than hydrogen or carbonic oxide? After you have made that, and have used up the carbon that is in the ordinary bituminous coal, you use from 5 to 25 per cent of cannel coal to raise the illuminating power.

Many of you know a great deal more about gas making than I do, and yet there are some principles which I think I do understand in relation to it. Carbon is not a gas but a mineral; and it has the peculiar faculty or power of assuming the form of gas and uniting with other gases. It is a mineral, and the light is given by its becoming incandescent at the moment of exposure to the atmosphere. Carbon will not carry itself off from the retort, but it must have a supporting or permanent gas to take it up and carry it off; as I said, you make your supporting or permanent gas, marsh gas or light carburetted hydrogen. What becomes of all the carbon until you have got that basis made? Look at your retorts. On the inside of them is pure carbon. Look at the twelve gallons of tar which you make per ton of coal, the greater part of which ought to be turned into gas. Look at the impurities that you make in your gas—sulphuretted hydrogen, ammonia and naphthaline, the greater part of which ought to be turned into illuminating gas. Why don't you turn it into gas? Simply, because you do not, under the present process, have a supporting gas at the time when it is volatilized to take it up and carry it off. It, therefore, becomes deposited in the retort.

I want to say that I did not come here to speak with regard to our process particularly, but on the subject of water gas generally, which, I think, is founded upon scientific principles. Water is the great antagonist of fire, and yet it is composed of the most inflammable elements in nature. By the decomposition of water you form hydrogen and carbonic oxide, which two gases produce the highest calorific intensity of any of the gases. That is what you want. If you get your gas up to a certain degree of candle power it will smoke. What you want is a proper combustion. Now, I say that a system of making gas which will produce a supporting gas of high combustion, to be present at the moment the elements of gases are vaporized ready to take up the carbons and carry them off, is the true system of making illuminating gas. That is what we do with water gas. There are different systems of making water gas. We were the first in the field, and have been the longest in it. We have run our process at Poughkeepsie going on five years. and have been making pure, simple, water gas, and we are running the process to-day, and making a gas of a uniform candle power of from 20 to 21 candles. We have no trouble in making it, and we have no trouble in keeping it up to a uniform quality. We differ from the process that has been discussed here this afternoon in this; that we have always worked with a continuous process. We heat by external heat, and they by internal heat, consequently, by their process, a draft of air is driven in until the heat is raised to incandescent or white heat, and then the steam is turned on. In a short time the heats are reduced so that they have to shut off the steam and turn the air on again. That is the way their process works. We run continuously, and therefore I say that in making gas uniformly, the chemical combination that takes place must be according to the heat that is applied. If you vary the heat you vary the combination. The result is chemical and cannot be avoided. We, therefore, hold that the uniform production of gas will require a uniform degree of heat, and that is the system which we are pursuing.

I may say here, with regard to the cost of it, that I believe there can be nothing in that respect that we are not able to state

in figures. We have run four and a half years, and we are ready to show our books to those who come here. I would like to state just what it costs us, but I do not think that it would be proper. I will state it to any individual in this Association privately.

MR. NEAL—How do you carbonize your gas?

MR. ALLEN—In regard to that a great deal has been said about the burning of the oil or the waste of the oil. I think we have the best system that can be devised. We have worked it until we think we have got it very nearly perfect. Our intention has been to show gas men that we are pursuing a scientific and chemical process. We vaporize our oil. The oil or naphtha, it is immaterial which, goes in with the hydrogen. If we use crude oil, it has some moisture in it, and it has to be dried, or undergo a process of drying, before sending it into the retort, while naphtha is entirely free from all moisture.

MR. NEAL—Do you use a small or secondary holder?

MR. ALLEN—No, sir; it is all made by one process. We turn our oil on, it goes into our vaporizer and retorts. Nothing is touched from the time it starts until it passes out into the holder. There is no manipulation at all. We have, for instance, two benches for hydrogen and one for oil. I wish to say a word with regard to hydrocarbons. Some of them are pretty volatile, and some are harder to break up. Any flash-in-the-pan, as you may say, carries it right off. That is not the proper way to do it. The most volatile carbons in the ordinary process are carried off before they get up to the point of gas making. That is the fruitful cause of the loss of carbon. We send our hydrogen into the centre or oil bench, and the naphtha and hydrogen pass down through the same vaporizer, and pass to the lower chamber of the double retort, and from there through the diaphragm into the upper chamber, and then up into the upper retort. We pass 100,000 feet from three benches. You will see that no part of the gas can pass without passing the same degree of heat; the more volatile passes off quicker, but there is the hydrogen to take it right up, and they are united immediately, and go through a degree of heat so that they become chemically formed. Now, when hydro-

gen and carbon are chemically united they cannot be separated, except by combustion ; and good gas does not condense. It is merely vaporized gas that condenses. We pass the whole of it through one uniform system. It comes out through one stand pipe, and you will see at once that there cannot be two qualities of gas. I do not believe in this system of making a rich quality of gas at one point, and turning it in and mixing it cold with a poor quality of gas. It will mix, but it is not chemically formed. After it has passed the hydraulic main, when no chemical action takes place except from the cold, which applied to it, will cause the poor gas to condense. It is very singular, but, notwithstanding, it is true, that carbon will so far unite with gas as to pass the water seal, and pass the purifiers into the holder, but will deposit as it goes into the mains, unless they are chemically united. I hold that we ought to make a gas, every foot of which, as it passes out of the retort, shall be perfect.

The Secretary—How many gallons of oil or naphtha do you use per thousand feet of gas?

Mr. Allen—We take about four gallons of oil to one thousand feet, and we use about seventeen pounds of anthracite coal in the retorts per thousand feet of perfected gas.

The Secretary—How much outside?

Mr. Allen—The benches take up, for running the fires, just about the same as the ordinary coal gas. The fires have the same size bench, and require about the same coal as they do under the ordinary process of making gas.

A Member—What price do you sell your gas for?

Mr Allen—$2 ; 5 per cent off.

A Member—Does your company pay any dividends?

Mr. Allen—Yes, sir. [Mr. Allen understood the question to be : Has your company *failed* to pay any dividends?]

Major Dresser—Can you give us the total number of pounds of coal used under the boiler to generate your steam, and under the retort for making your gas? You stated that you used about 17 pounds of anthracite coal in the retort per

1,000 feet ; this, added to what you use under the boilers and in the furnaces, would give us the total pounds of coal per 1,000 feet of gas.

MR. ALLEN—I did not expect to discuss our particular process, and I did not bring the figures with me. If Mr. Harris, our engineer, had come, as I supposed he would, he would have brought the figures with him. If I had supposed that the discussion would turn upon our particular process I would have been ready with the figures myself. I only wanted to speak upon the principles of gas making, and of the differences between making water gas and the ordinary coal gas.

MR. PAGE—What difference do you find in carbonizing your gas between using the oil that we sent you and naphtha?

MR. ALLEN—We use the crystal oil for fuel and not for carbonizing.

MR. PAGE—Referring to naphthaline, are you aware of the fact that a patent has been taken out by a foreigner to use naphthaline, and that the product that he makes from his patent is worth not less than $100 a ton?

MR. ALLEN—I was not aware of that. I do not suppose that gas companies intend going into the business of making naphthaline and tar. I go upon this principle : We do not bring into the yard anything that is not made into gas. We have nothing to sell. You talk about selling the coke, and talk about selling tar. I don't suppose that gas men are going into any business except that of making gas.

MAJOR DRESSER—Do you receive your naphtha on tank cars?

MR. ALLEN—Yes ; it is pumped up into the tank out of the cars?

MAJOR DRESSER—You pay for the naphtha according to the gauge of the tank car?

MR. ALLEN—We buy it as it comes in the tank car?

MAJOR DRESSER—Can you tell us the loss by evaporation or leakage on measuring out the oil from your tanks into your works, and the loss in transportation on naphtha?

Mr. Allen—No, I cannot. I have not the figures with me, and I cannot state the fact in that regard. We have a gauged tank in the gas works, and we use it.

Mr. Page—Have you had an explosion of naphtha?

Mr. Allen—No, sir. We had a small measuring tank in a corner of the retort house. It had a glass measuring tube, and the men were charged never to turn their backs on it until the gauge tank was full. The man who tended it, a good and faithful man, left it open this summer. The tank is the usual distance from the furnace. The man left the faucet open, and the naphtha ran from there, took fire, and ran right up over the glass tube and broke it. The oil ran out and made an intense heat which warped the iron of the roof and drew the iron rods out, and brought the roof down at that end. At any rate, the authorities inquired into it, and sent a committee down to our works to investigate. They reported that there was not as much danger from our tank there, as there was from a single barrel of naphtha kept in a drug store in Main street.

Mr. Forstall—How do you vaporize your naphtha, by the ordinary steam heat?

Mr. Allen—Yes; it is vaporized by steam.

Mr. Forstall—Does the steam reduce all but one per cent. of the oil into vapor?

Mr. Allen—It does; it passes into the retort. We have no residum at all.

Mr. Littlehales—Have you any formation of carbon in your retorts?

Mr. Allen—No, sir.

Mr. Sherman—What kind of coal do you use?

Mr. Allen—Anthracite.

Mr. Sherman—How many thousand feet do you put into your holders per ton of coal?

Mr. Allen—I have not figured that up, but if Mr. Harris were here he could probably give you the figures. I should have been able to do so, had I supposed the discussion would have taken this turn. I only rose to speak upon general prin-

ciples of the difference between the processes of coal gas and water gas. I did not get up to speak about our particular process.

Then with regard to the use of water gas for heating purposes, I would say that the expense of purifying for heating purposes is not necessary at all; therefore, it is produced very cheap, and for heating purposess would be of great advantage.

MR. PRICE—Wouldn't it be necessary, in making gas for heating purposes, to have a double set of pipes?

MR. ALLEN—Yes, sir.

MR. PRICE—And another holder?

MR. ALLEN—Yes, sir.

MR. PRICE—And it would be also necessary to have separate bills for the gas as you would sell at different prices?

MR. ALLEN—Yes.

MR. PRICE—I would like to inquire whether you still superheat your steam?

MR. ALLEN—Yes; we superheat it, and send it into the retort as dry as steam can be made.

MR. STARR—What is the effect upon your meters? I have seen meters where they have been working the oil process which have dried up and have leaked badly.

MR. ALLEN—That all comes from an improper system of making gas. I have seen works where they made water gas, and have heard of it at different places where water gas is imperfectly made, where there is a gummy substance or an oily substance carried forward in the burners, but that is because the gas has not been properly made.

MR. STARR—With your process, if there is any mistake in the manufacturing, will careless manufacturing produce the same result?

MR. ALLEN—We can make it poor. There is no necessity, however, for making it poor. If you send in more oil than the hydrogen will take up you will undoubtedly have a residum; but our system is so perfect that the most ordinary hired men

running the works know what to do. Unskilled labor will run it without the least trouble. Both Mr. Harris and myself are very seldom there. But the men can tell just the quantity which needs to be run. We have, however, a jet photometer in the office, and if it is running too low, we will tell them of it, and they will turn it on a little more. If it is running too high, they will shut it off.

THE SECRETARY—How many men do you employ?

MR. ALLEN—We employ two in the day and two in the night, and they can make about 100,000 feet. We send out but 60,000 or 70,000 feet, and the same labor and the same force can just as well make 100,000 feet.

MR. STARR—Suppose you wanted to make only 25,000 feet, would you still have to have four men?

MR. ALLEN—No, sir; two men will attend to six benches.

MR. STARR—You can make 50,000 with two men?

MR. ALLEN—It takes just as much force to make 50,000 as it would 100.000.

MR. LITTLEHALES—I move that the thanks of the Association be tendered to Mr. Allen for the very clear manner in which he has expressed his views in this discussion. I never have heard expressed, in so clear a manner before, the relations of hydrogen and carbon to gas making; and I think that every member of the Association has been benefitted by Mr Allen's remarks.

Carried.

The Secretary read a letter from Mr. J. D. Patton, with reference to his paper presented at the Cincinnati meeting; and it was moved and seconded that the paper be published with the proceedings of this meeting.

Carried.

The paper was as follows:

ON REGULATION OF PRICES.

I have for a long time been deeply impressed with a belief that every consideration of security and advancement of the

various manufacturing interests demands the general establishment of a lower range of prices for gas light.

In a paper read at the meeting of this Association in 1875, this view was expressed in the following words:

"Your consideration of this matter involves not so much the advancement of your position as the holding of it. The position of all large and well-managed gas companies is, financially, as good as they can hope to make it. They cannot well increase their percentage of profit without eliciting public clamor and opposition, and the advantages they can expect from improved methods of gas making are in the line of such improvements as will enable them to furnish a cheaper light to their consumers"

The average prices charged for gas to-day are practically the same as they were years ago, when the only competition was with high-priced oils and the execrable tallow dip.

The immense production of petroleum, and the very low prices at which it is sold, have enabled it to drive these competitors from the field, and to encroach very seriously upon the gas consumption.

This competition with petroleum in some of its various forms—kerosene, gas, or gasoline—has been felt by nearly every gas company in the country, and in many of these instances the situation is serious.

A general readjustment of prices two or three years since, when the need of such action first became apparent, would, in my opinion, among other benefits, have saved some of the gas companies from the equally disagreeable alternatives of crushing out or buying up opposition works.

The prevalence of opposition gas schemes, at this time is, doubtless, in great part, due to a very general, but not very harmonious, belief that the prices charged by the gas companies are exhorbitant, and that the established gas companies cannot manufacture gas at prices as low as the various plans for manufacturing an imitation of their product can work.

The fact, so seduously kept from public knowledge, that the actual cost of manufacturing coal gas, and delivering it into the gasholder, is but a fraction of the price usually charged for it,

is known to but very few persons outside of the business; and one result of this ignorance is the general belief (before referred to) that gas can be made in larger quantities and vastly cheaper by other methods: and hence, in part at least, the readiness of a too credulous public to invest money in opposition works, and to enter into a contest, the possible magnitude of which they do not dream of, and into which they would be less likely to enter, were they aware of the real facts of the case.

The opportunities thus afforded have been improved by speculators in many of our larger cities, and the way will be none the less easy for them to travel as long as gas manufacturers insist upon prices not warranted by the cost of production, and regardless of the demands of competition.

I am aware that many of the gas companies think they cannot reduce prices without loss of dividends. But is this really the case?

It may seem to a corporation doing business upon a greatly exaggerated stock value, and requiring more than one-half of all its present revenues to meet its dividends, especially when these revenues are diminishing, and are subject to a heavy leakage and repairs account, that a reduction in price of gas would be disastrous, and to those companies working on better bases it might seem very undesirable. Were there no compensations for such reductions, the excuse we "cannot afford it" might be valid.

But there is no gas consuming community in this country where a reduction from a high price for gas to a satisfactory one, would not be followed by some increase both in the amount consumed by present consumers, and in the number of consumers. This increase might not at first return more than a portion of the loss by the reduction of price; but in some instances that I have known, it has fully replaced the amount.

And, on the other hand, it is easy to instance gas companies who, by their endeavor to maintain prices, have thus lost valuable consumers, and invited opposition, and, after all, have been compelled to make greater reductions than were at first necessary.

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gas in the town. And even after this, and after the pipes were laid and generators were built, no attempt was made to supply the confiding public with a better and a cheaper gas, or to make any returns from the works, lest the competition should serve as a centennial warning instead of a centennial advertisement.

Believing that you all appreciate the importance of a proper regulation of prices, so that they may produce the greatest possible gross revenue, and that business liberality is as likely to be successful in gas manufacture and sale as in any other business, I will not trespass further on the time of the Association.

MR. CARTWRIGHT—Before we finally adjourn, I wish to make a motion which I hope will be very heartily responded to. We have been profuse in tendering our thanks for everything pertaining to this Association ; but I think we have omitted one very important duty in this direction, that is to tender our thanks to the gentleman who threw himself into the breech four or five years ago, in a position that required just such energy, and just such integrity, and just such force as he has shown himself to be possessed of. I, therefore, propose that the Association tender to Mr. Nettleton its most sincere thanks for the manner in which he has discharged the duties of Secretary during the years that he has filled that position. I think it is eminently proper that this expression on our part should be given, and hope that it will be given as freely as any other vote of thanks that has been given to-day. [Applause.]

THE PRESIDENT—It has not fallen to my lot to present before you a motion which more entirely accords with my own feeling than the motion of Mr. Cartwright. I should vote for it with half-a-dozen hands if I had them.

MR. NEAL—I move that we take a rising vote.

A rising vote of thanks was then tendered to Mr. Nettleton.

THE SECRETARY—I must be permitted to say a few words even at this late hour. It has been most gratifying to me to listen to the kind sentiments that have been expressed. Such sentiments, expressed in the generous manner that these have

been, warm and refresh the better side of human nature, and are a compensation for my several years of service as your secretary and treasurer, far above money value. It is a compensation, bright, cheerful, continuous, and will run with me as a part of my existence through all the rest of the years of my life. I have another satisfaction, personal to myself, inherent in my own consciousness—that is, that I have done my best to serve you, as your secretary and treasurer for the last five years, and now looking back over the field with the present knowledge of what was desirable to be done, if I were called upon to execute the duties of those offices for the same term of years again, I could not improve much on the past.

I thank you, gentlemen ; I thank the officers and all the members of the Association for their kindness and courtesy during my several terms of office. I thank them for the manner in which they have sustained and aided my efforts to make the American Gas Light Association a strong and prosperous institution.

It has been suggested that the present strength and prosperity of our Association was the result of the efforts of your secretary and treasurer. I cannot accept an award of praise so broad, general and exclusive as that. No secretary of an association, kindred in nature to the American Gas Light Association, can of himself create a successful association ; he must have the aid and assistance of the members of the association, or his efforts, however zealous, however discreet, will fail in their results.

Many of you have worked sincerely, with great earnestness and with persistence, for the welfare and interest of the Association. I must mention the *American Gas Light Journal*, and its editor, Major Dresser. He has performed arduous and most persistent services for the the benefit of the Association. To him, both individually and as editor of the *Journal*, the Association and its members are largely indebted for its present prosperous and highly gratifying condition.

I hope at future meetings, as a private soldier in the ranks, to have the privilege of taking part in the deliberations and discussions. For the last five years this privilege has been de-

nied me by the exacting duties of the offices of Secretary and Treasurer.

In closing, permit me to express the wish, that in future years the American Gas Light Association may have a growth and prosperity which shall be its manhood, to which its present condition, by comparison, is only its youth. To you, the members of the Association, I wish you all happiness, and "may you live long and prosper." [Applause.]

On motion of Mr. Cartwright, the Association adjourned *sine die.*

EIGHTH ANNUAL MEETING

OF THE

AMERICAN GAS LIGHT ASSOCIATION,

Held at Chicago, Ill., October 13, 14 and 15, 1880.

MORNING SESSION—OCT. 13.

The meeting was called to order at 11 A.M., the President, Mr. W. H. Price, in the Chair.

THE ROLL.

During the meeting the following members were present:

Honorary Member.

G. WARREN DRESSER, C.E., New York City.

Active Members.

Allen, A. L.,	Poughkeepsie, N. Y.
Allyn, H. A.,	Cambridge, Mass.
Andrew, J.,	Chelsea, Mass.
Averill, A. T.,	Cedar Rapids, Iowa.
Battin, Isaac,	Albany, N. Y.
Brown, T. R.,	Philadelphia, Pa.
Butterworth, T.,	Rockford, Ill.
Borgner, C.,	Philadelphia, Pa.
Barret, A. H.,	Louisville, Ky.
Beale, W. R.,	New York, N. Y.
Burtis, P. T.,	Chicago, Ill.
Cartwright, W.,	Oswego, N. Y.
Cabot, G. D.,	Lawrence, Mass.
Coggshall, H. F.,	Fitchburg, Mass.
Collins, C.,	Chicago, Ill.
Clark, Jr., E. W.,	Philadelphia, Pa.

Cartwright H.,	Philadelphia, Pa.
Cowing, J. H.,	Buffalo, N. Y.
Curley, T.,	Wilmington, Del.
Cushing, O. E.,	Lowell, Mass.
Crafts, D. W.,	Northampton, Mass.
Diall, M. N.,	Terre Haute, Ind.
Dwight, G.,	Springfield, Mass.
Denniston, W. H.,	Pittsburgh, Pa.
Frost, W. H.,	Plymouth, Mass.
Fuller, H. M.,	Greenville, Mich.
Forstall, T.,	New Orleans, La.
Gardner, Wm.,	Pittsburgh, Pa.
Gerould, H. T.,	Cairo, Ill.
Goodwin, W. W.,	Philadelphia, Pa.
Gates, F. W.,	Hamilton, Ont.
Hickenlooper, A.,	Cincinnati, O.
Hookey, G. S.,	Augusta, Ga.
Howard, L. J.,	St. Louis, Mo.
Helme, Wm.,	Philadelphia, Pa.
Hendly, J.,	Beloit, Wis.
Hopper, Thos. C.,	Philadelphia, Pa.
King, E. J.,	Jacksonville, Ill.
Ludlam, E.,	Brooklyn, N. Y.
Littlehales, T.,	Hamilton, Ont.
Miller, W. H.,	Columbus, O.
Merrifield, P. S.,	Troy, N. Y.
McDonald, Wm.,	Albany, N. Y.
McElroy, J. H.,	Pittsburgh, Pa.
Moses, G. W.,	Chelsea, Mass.
Neal, G. B.,	Charlestown, Mass.
Odiorne, F. H.,	Boston, Mass.
Page, G. S.,	New York, N. Y.
Pearson, W. H.,	Toronto, Ont.
Patton, J. D.,	Hicksville, O.
Pratt, J. C.,	Jamaica Plain, Mass.
Parritt, W.,	Bloomington, Ill.
Price, W. H.,	Cleveland Ohio.
Prichitt, S.,	Nashville, Tenn.
Raynor, C. H.,	Adrian, Mich.

Rogers, J. F.,	Jamaica Plain, Mass.
Rollins, J. H.,	Worcester, Mass.
Rice, E. S.,	Logansport, Ind.
Richardson, G.,	Wilmington, Del.
Richardson, A. W.,	N. Adams, Mass.
Root, F. M.,	Connersville, Ind.
Ramsdell, G. G.,	Vincennes, Ind.
Scott, I. R.,	Waltham, Mass.
Slater, A. B.,	Providence, R. I.
Sommerville, J.,	Indianapolis, Ind.
Spencer, R.,	Burlington, Iowa.
Spear, J. Q. A.,	Dorchester, Mass.
Starr, J. M.,	Richmond, Ind.
Smith, M.,	Wilkesbarre, Pa.
Turner, T.,	Charleston, S. C.
White, W. H.,	Brooklyn, N. Y.
Wood, A. C.,	Syracuse, N. Y.
Weare, C.,	Marshalltown, Iowa.
Watkins, E. T.,	Chicago, Ill.
Wood, Gideon,	New Bedford, Mass.
Weber, A.,	New York, N. Y.

THE PRESIDENT—The first thing in order is the reading of the minutes of the last meeting.

MR. SLATER—I move that the reading of the minutes be dispensed with.

Carried.

THE PRESIDENT—The next business in order is the reading of applications, notices, and reports for new members.

THE SECRETARY—I have the applications of a number of gentlemen for membership in this Association. They are accompanied by the usual fee, and the gentlemen have the necessary qualifications. The names of the applicants are as follows:

D. D. FLEMING, Jersey City, N. J.

E. S. RICE, Logansport, Ind.

C. COLLINS, Chicago, Ill.

E. G. SPAULDING, Buffalo, N. Y.

G. W. MOSES, Chelsea, Mass.

L. J. HOWARD, St. Louis, Mo.

A. T. AVERILL, Cedar Rapids, Iowa.

E. J. KING, Jacksonville, Ill.

G. S. PAGE, New York City.

H. M. FULLER, Greenville, Mich.

E. W. CLARK, Jr., Philadelphia, Pa.

C. WEARE, Marshalltown, Iowa.

C. BORGNER, Philadelphia, Pa.

A. WEBER, New York City.

These applications have all been laid before the Executive Committee, and they recommend the election of the applicants.

THE PRESIDENT—What course will you take with these aplications ?

MR. DENNISTON—I move that the Secretary be authorized to cast the vote of the Association, unless there is objection.

Carried.

Major Dresser was appointed teller.

THE PRESIDENT—If there is no objection, the Secretary will, in compliance with the request of the Association, and in accordance with our usual custom, now proceed to cast the ballot of the Association for the gentlemen whose names have just been read.

The Secretary then cast the vote of the Association for the gentlemen named, and they were declared by the President to be unanimously elected members.

THE PRESIDENT—According to the rules of the Association, the gentlemen just elected are requested to rise and be presented to the Association.

MR. BURTIS—Article VIII. of our Constitution provides that new members, when elected, shall sign the Constitution of the Association. As the members elected this morning are all present, I think it would be entirely proper that they should come forward and sign the Constitution now.

The President—Inasmuch as the signing of the Constitution would make some confusion, the newly elected members shall take occasion to do so during the recess.

The Secretary—There are a number of the older members who have neglected to affix their signatures to the Constitution. They will oblige me by coming forward during the recess and signing the same.

The President—You have provided in your order of arrangement for the transaction of business, that the President shall deliver an address. I have prepared some remarks, which I will now proceed to read.

THE PRESIDENT'S ADDRESS.

Gentlemen of the American Gas Light Association :— I have much pleasure in welcoming you, each and all, to this our eighth annual meeting. Albeit not a denizen of this great city I may be permitted to give you welcome, thrice welcome to this metropolis of the Northwest, the marvellous product of the energy, the industry, the perseverance and the thrift of the children of many nations who have made their homes upon her fertile lands, beneath her genial skies, and under the protection of her free institutions.

It is a time of intense political excitement ; the air is rent by the cries of contending parties ; but with us, while here, there is no north, no south, no east, no west. We come from every section of our beloved country, and some of our members come from the dominion of a sovereign, whose long and benignant reign has been a blessing to her subjects and an honor to her sex. Yet here we meet as brethren. Whatever may be our personal opinions upon questions of governmental policy, all contention in regard to them is hushed, and while here we shall devote ourselves to the consideration of matters relating to our daily duties as representatives and managers of an important and widely extended industry, and to those social enjoyments which soften, brighten and elevate our lives. For one, I am glad, and I think we shall all be glad, to escape the din and the excitement of a political contest for even the brief time devoted to this convocation. We shall, I trust, find

it restful and refreshing to give these three days before us to the consideration and discussion of themes connected with our special calling; and when they shall have passed away, I hope we may go to our respective homes feeling that it has been good to have been here.

The year that has passed since our last annual meeting has not, so far as I am aware, been distinguished by any remarkable changes in the condition of the gas lighting industry in either our own country or in foreign lands. There has been, however, a steady decline in the price of gas—in some instances a large decline—and an eqûally steady advance in measures demanded to meet the new conditions.

In regard to the first point, I have been for some time a believer in the doctrine that our companies should make their money, as all large manufacturing industries in the long run, make theirs—by large sales at a small per cent of profit. Gas is a comfort, a luxury, which we should aim to bring as nearly as possible within the reach of all. In this matter our interest runs in the same direction with an enlightened public spirit. Our only real competitor is petroleum, and that, at the low price prevailing for the last few years, and, by the use of improved lamps, is a *real* competitor. Yet in our larger towns, where a liberal consumption may be secured, if the gas works are in the best condition, if labor be judiciously applied, if good material be used, if the expense of distributing be kept at a low point, and if stockholders are satisfied with moderate dividends upon genuine unwatered stock, gas may be sold at a price which will make the margin of cost between good gas light and poor oil light very narrow.

With your leave, I will indicate some lines in which a steady advance in the right direction has been made during the last year.

1*st.*—*The Best Furnaces for Heating Retorts.*

It is obvious that managers of gas works must, ere long, adopt improved furnaces. The old furnaces, in which 40 to 50 per cent of the coke produced is consumed in carbonizing, must be discarded, and some form of the many now claiming attention must take their place. If there be a furnace, as I

am confident there is, which will require not more than 25 per cent, perhaps not more than 15 per cent, of the coke made—which will require much less labor in firing and clinkering, before which the laborer can work in comparative comfort, and above all, which will much more effectually heat the bench, making every retort equally useful from end to end—that furnace must be adopted. I do not undertake to indicate which is the better; indeed, I do not know; but that which is best must be searched out and must be introduced, and the discussions of the past year have helped a good deal in this direction.

2d.—The Best Scrubber.

One reason why gas can be sold so very low in the old world, especially in the British Isles, is the fact that the saving and utilizing of residual products have been there carried to a high degree of perfection. One of those residual products is ammonia. In this country that product has been, and is now, largely wasted. But it is a valuable product. In order to secure a successful working of the ammoniacal liquor produced in your works, you must have such scrubbing apparatus that you can take from your gas as it passes nearly all its ammonia, and save it in a concentrated form. Some scrubbers do this, and some do not. The truth as to the best scrubber has been slowly evolving for some years, and this matter has made considerable progress during the last year.

3d.—The Best System of Carbonizing.

I think I am correct in saying that fifteen years ago most gas managers were content with a product of from 4.26 to 4.50 cubic feet per pound of coal carbonized, and, as a matter of fact, the former figure was more generally the limit than the latter. Now our average 5 feet is not considered extraordinary, and a few obtain a much larger product than that.

I have lately visited a works in which I was assured that more than an average of 6 was obtained, and I was credulous enough to believe the statement. However that may be, it is well settled that 5 feet and more may be made from every pound of good coal carbonized in your works. Time, quan-

tity, heats and enricher—all these items must be considered and adjusted in determining the best process for obtaining the largest yield of good gas. Poor quality will not be tolerated.

The past year has contributed something toward a solution of the question: What is the best system of carbonizing?

4th—The Application of Machinery to the Charging and Discharging of Retorts.

One year ago I ventured to call your attention to machinery invented by Mr. Ross, and in use in the works of the Cincinnati Gas Light and Coke Company, and I beg leave to again call your attention to that machinery. I have a good deal of confidence in it, and I understand that much abler men than I am have endorsed it, and that it is likely to have a thorough trial in one of the largest works in America. I only ask you to examine it for yourselves. If that machinery is a success, the inventor has conferred a great benefit upon the gas fraternity.

5th.—Improved Burners and Improved Lanterns.

Perhaps no article of domestic comfort is more injudiciously and more wastefully used than that which you furnish, and no department of effort deserves more attention than this—the introduction of the best burners, and in our streets the best lanterns.

You may visit the house of one neighbor, and you will find the most perfect illumination; and you will find in the dwelling of another, cheerless, half-lighted rooms, and yet perhaps the latter is consuming more gas than the former. The difference may be wholly caused by the burners employed. During the past few years, and especially the one just passed, much has been written and much has been done to remedy this difficulty. And this remark will apply to street lanterns. Some are adapted to their work and many are not. Too often the selection of the proper lantern is left to some chairman or some committee stupidly ignorant or indifferent. Sometimes the coaxing blandishments or the insinuating bribe of some scheming manufacturer of a "new and improved lantern" wins the day, and the wayfaring pedestrian curses good gas and de-

nounces it as poor, when the whole difficulty lies in the burner used for its combustion, or the instrument used for its protection and diffusion, or both.

6th.—Day Consumption.

Probably greater advance has been made during the last year in promoting the use of gas in the kitchen, the laundry and the engine room, than in any preceding year. I think this must be certainly true in our own country. In towns where gas is sold at a low rate a great many cooking and laundry stoves have been placed, and usually with much satisfaction to the parties using them. This good work will go forward.

So also the introduction of gas engines for many purposes is making rapid progress, and will progress more rapidly in the future.

The importance of promoting these various forms of day consumption is obvious to every gas man, and I need not dilate upon it here.

Thus, gentlemen, I have hurriedly referred to the march of improvement in your department of labor, as it appears from my standpoint. There might be much said upon many points of interest, as, for example, water gas, electric lighting, etc.; but these introductory remarks have already been extended quite far enough—perhaps too far, for I am sensible that I have said nothing new. It is now for you, gentlemen, to make this convocation eminently profitable and interesting.

THE PRESIDENT—Next in order is the report of the Executive Committee in regard to the management of the Association during the past year.

MR. H. CARTWRIGHT—I beg to refer to the report of the Executive Committee in the hands of the Secretary, who will be kind enough to read it.

EXECUTIVE COMMITTEE'S REPORT.

The Secretary then read the report of the Executive Committee as follows:

CHICAGO, Oct. 13, 1880.

The Executive Committee of the American Gas Light Association respectfully report that they have examined and approve of the following papers offered for their examination, as per Article XXV. of the Constitution:

"Stoppage of Ascension Pipes," by Theobald Forstall, of New Orleans, Louisiana.

"Steam Stoking Inventions," by A. Hickenlooper, of Cincinnati, Ohio.

"Gas Engines," by George G. Ramsdell, of Vincennes, Ind.

"Illuminating Power as a Basis for Compensation," by H. H. Edgerton, of Stamford, Conn.

"Lowe Process of Gas Manufacture," by W. H. Pearson, of Toronto, Canada.

"Coal Tar Products and Ammoniacal Liquor," by G. S. Page of New York, N. Y.

"Gas Furnaces," by Adam Weber, of New York, N. Y.

"Consumers and Test Burners," by E. G. Love, of New York, N. Y.

"Heating by Gas," by W. W. Goodwin, of Philadelphia, Pa.

Ten members being three or more years in arrears, and having been duly notified thereof, we recommend that they be dropped from the roll of members. The proposed amendment to Article XVII. of the Constitution, changing the annual meeting from the third Wednesday in October to the third Wednesday in May, having laid upon the table for the required year, we recommend that it be considered by the Association.

We recommend that the Secretary be directed to proceed to the publication of Volume IV. of the Proceedings of the Association, including therein the Seventh and Eighth Annual Meetings.

We recommend that a committee be appointed to prepare a table of standards for the use of this Association, to the end that all papers presented here and discussions had on such papers may be based upon a common standard of results and comparisons.

We recommend that the salary of the Secretary and Treasurer be fixed at $300, with an allowance, not exceeding $100, for expenses during attendance at meetings.

We give notice that an amendment to Article IV. of the Constitution has been proposed, so that that Article will have added thereto the words "and industries relating thereto."

Respectfully submitted,

HENRY CARTWRIGHT,
A. C. WOOD,
JAMES M. STARR,
P. T. BURTIS,
GEO. S. HOOKEY,
Executive Committee.

WM. HENRY WHITE, *Secretary.*

THE SECRETARY—I would respectfully state that in regard to the recommendations of the Committe in reference to those members who have not paid their dues, that they have persistently refused to take notice of the circulars sent them upon the subject. It is not necessary that those names should be mentioned. The Committee simply recommend the dropping of the names from the roll. I move you, sir, that this report of the Committee be accepted and the recommendations taken up *seriatim.*

Carried.

THE PRESIDENT—The next business in order is the report of the Treasurer.

TREASURER'S REPORT.

The Treasurer then submitted the following report :

NEW YORK, Sept. 30, 1880.

Receipts.

To cash balance, Oct. 1, 1879........	$1,097 85	
Initiation fees....	240 00	
Dues for year.................... .	640 00	
Back dues.........................	163 00	
Dues for 1881 paid in advance........	15 00	
Twelve volumes of Proceedings, at $1.25	15 00	
Two volumes of Proceedings, at $1.50	3 00	
Interest on deposits, July 1, 1880......	22 50	
	———	$2,196 35

Disbursements.

By cash, publication of Vol. III. of Proceedings	$676 75	
Salary of Secretary and Treasurer...	300 00	
Postage............................	56 61	
Printing and stationary..............	27 35	
Sundries...........................	22 10	
Balance in banks	1,112 50	
Balance on hand................	1 04	
	———	$2,196 35

It was moved and seconded that the report of the Treasurer be referred to the Finance Committee for their approval.

Carried.

MR. FORSTALL—In the absence of the Chairman of the Finance Committee, I beg to report that the members of that Committee who are present have examined the report of the Treasurer, and his vouchers, and have found them correct.

THE TREASURER—Mr. Chambers was unable to come, but he examined the accounts in New York and found them correct, and certified to them.

THE PRESIDENT—Have you, Mr. Forstall, certified upon this report the results of your examination ?

MR. FORSTALL—Yes, sir ; the members here have all signed it.

THE PRESIDENT—The next business in order is the reports of Special Committees.

THE SECRETARY - There is a report due the Association upon the subject of standard test burners, from a committee consisting of Mr. C. Nettleton, Major Dresser, and Mr. Sherman. Major Dresser is the only member of that Committee present. There is also a report due from the Committee on Unaccounted-for Gas, which was continued over from the last annual meeting. These are the only special committees. The members of the latter committee are Mr. A. C. Wood, of Syracuse, and Mr. C. A. White.

THE PRESIDENT.—Are those committees prepared to report?

MAJOR DRESSER.—As the only member of the Committee on Burners present, I would state that we desire simply to report progress. We have had several consultations upon this matter, and a series of experiments were undertaken for determining the questions that have been submitted to us; and as the Committee were about going on with them, we received the most able report of a committee of the British Association for the Advancement of Science, a part of which was published last year drawn up by Dr. Wallace, and a part this year by Mr. John Pattison, F.C.S., F.J.C. We found this report was so able and complete, bearing upon this subject and upon all the different burners that were presented in the market, that we felt it was not fair for us, as a committee of this Association, to submit a complete report to this meeting, as we had not prepared anything like the information we desire to give. But, with the information embodied in these papers, your committee will be able to go more fully and completely into the matter; and we hope in another year to submit a report that will be satisfactory. We would therefore simply report progress, and ask that the committee be continued.

THE PRESIDENT.—You have heard Major Dresser's report; is it your pleasure that this committee be continued for another year, and requested to complete their report?

On motion, the Committee was continued for another year.

THE PRESIDENT.—Mr. A. C. Wood, a member of the Committee on Unaccounted-for Gas, is present, and we would like to hear this report.

MR. WOOD.—I think that Mr. C. A. White, of Rochester, was chosen as the Chairman of that Committee, but he is not present. I will simply state that this Committee is not ready report. As for myself, I must acknowledge that I have not the skill and ability to establish a uniform rule for unaccounted-for gas. The conditions change with every company. Mr. White claimed that he had discovered a solution of this problem, and I have left the matter wholly in his hands, and I supposed he would be here to present his solution. I think that perhaps Mr. White may have failed in reaching the conclusions which he expected would solve the problem, and I do not think there is any necessity for a continuance of this Committee. I think the matter of Unaccounted-for Gas is one that must be left to each engineer and superintendent of gas works to deal with as best he may. I believe it is utterly impossible to establish a uniform rule to govern that question, and I would therefore ask that the Committee be discharged.

THE PRESIDENT.—It is possible that Mr. White may be present before the meeting closes.

THE SECRETARY.—I received a letter from Mr. White, stating his utter inability to be present. He made no reference to a report, however, although I notified the members of these special committees some two or three months ago, that reports were due from them at this meeting.

MR. WOOD.—If there is any desire to continue the matter in the hands of Mr. White, I will withdraw the request I made.

THE PRESIDENT.—I hope the Association will not drop the question. It might therefore be advisable to reconstruct the Committee, including Mr. Wood, of course, and request a re-

port at the next annual meeting. What is your pleasure in regard to that?

MR. CABOT.—I move that the matter stand as it is for another year. At the expiration of that time if it is necessary to dissolve the Committee we can do so.

THE PRESIDENT.—It is moved that the consideration of this question be postponed until the next annual meeting, and that the present Committee be continued until that time. (Carried.) Do you, Mr. Wood, wish anybody else associated with you?

MR. WOOD.—I do not think there will be any necessity for that. I think Mr. White will cover the whole subject.

MR. PARKHURST.—I rise to get information on a question of privilege. I represent the Coldwater Gas Light Company, as its president. I find that my name is not upon the roll, and I feel somewhat in doubt as to whether I am a member or not. Some three years ago I notified the Secretary of the fact that Mr. Wilder, who had represented our company, was no longer in our employ, and was no longer engaged in the business, and asked that the transfer of membership be made from Mr. Wilder, who was the superintendent, to the president of the company.

THE PRESIDENT.—The Secretary can probably explain that.

THE SECRETARY.—If the gentleman will yield a moment, I will explain the matter, I think, to his satisfaction and the satisfaction of the Association. The Secretary last year ordered so many copies of the Constitution containing the list of members that it seemed a waste to throw them away, so I have made use of them. These copies do not contain your name, because when they were printed you were not a member. Your name, however, appears upon the books of the Association as a member, and when the list is reprinted it will appear there.

MR. PARKHURST—That explanation is entirely satisfactory.

THE PRESIDENT—It is now proper to proceed to the election of officers. Our custom has been to appoint a committee to make a report of suitable names for officers for the ensuing

[illegible] up and dispose [illegible]

[illegible] amendment to our Constitu- [illegible] would be well to [illegible] will be possessed of [illegible] of at least one [illegible] Committee, and [illegible] shall be made at [illegible] and the Committee [illegible] bear that in mind [illegible] the last page of the [illegible]

[illegible] present instance the [illegible] I will name the [illegible] suitable names [illegible] ensuing year: Henry [illegible] Wood, [illegible] that these gentlemen meet [illegible] Association this [illegible] report at that time.

[illegible] reading of papers [illegible] Mr. Forstall's [illegible] Committee. It [illegible] paper of Mr. [illegible] Executive [illegible]

[illegible] is the adop- [illegible] changing that Article [illegible] insert the word [illegible] The annual meeting will be [illegible] I move the adoption [illegible]

[illegible] exchange of opinion [illegible] hurriedly and in- [illegible] would be greatly [illegible] will not hesitate to express [illegible] very glad to hear from the members [illegible]

MR. DENNISTON—This Association now meets but once a year. When it met twice a year, it met in May and October. The object is to meet at a time that will suit members better than October. I, therefore, move an amendment to the report of the committee fixing the time in September. At that time the members of the gas fraternity have not reached the busy season that they have in October, and it will suit many members better than May, and that will not conflict with the Western Association, which, as I understand, meets in May, and those who desire to attend both meetings cannot do so very well in the same month. I, therefore, move to strike out May and insert September. I would say that, so far as I am personally concerned, one month would suit me as well as another. The members from the East make up their accounts in the month of October, and I think it would be very inconvenient for them to meet just at that time when everything is pressing in regard to their accounts.

MR. HICKENLOOPER—It would seem to me proper that the Association should meet at a date earlier rather than later than the one named by the committee, for the reason that the summer season is the one when we make changes for the winter's work ; and if there is any benefit to be derived from our attendance upon the meetings of this Association, it should be acquired just previous to the time when we are making changes and improvements. I, therefore, think that April would be a better month than either of the others named.

THE PRESIDENT—The amendment proposed by Mr. Denniston, substituting September for May, is in order.

MR. FORSTALL—I believe I was the one who suggested the change. My object in selecting the month of May was that in October we are generally all busy. There are many members who cannot leave their works at that time. My purpose was to select some month when it would be the most convenient for us to attend. The amendment suggested by General Hickenlooper would meet my views perfectly. Or the amendment recommended by the Executive Committee may be changed so as to make it the first Wednesday in May instead of the third Wednesday. That would avoid conflict

with the Western Association, and allow us to compare notes before making changes during the summer for the next season's business. Our object in coming here is to compare notes and decide when we get home, whether we shall make certain alterations and improvements in our works. I think it is better that the meeting should be held before rather than after we have decided upon our next winter's work. I, therefore, suggest the first Monday in May instead of the third Wednesday, as recommended by the Committee.

MR. HICKENLOOPER—I suggested April for the reason that if the date recommended by the Committee should be changed, we might fix upon an earlier date than the one recommended by them. While I am not opposed to the recommendations of the Committee, I think if we are to alter the date, we should fix upon an earlier rather than a later one.

THE PRESIDENT—The members of the Association will bear in mind that in some of the northern sections of the country the spring opens very late. Sometimes the snow is not gone in April. It would be well to consider all these matters. I feel personally, very desirous that the question should be very carefully settled, and settled so as to stay settled.

MR. DENNISTON—The reason why I made a motion to amend was not so much on my own account as for the reason that, having had some talk with members of the Western Association, I found that they were very much opposed to meeting in May. They did not want to meet in May as recommended by your committee, for the reason that their Association meets in May, as I stated before. I recognize the soundness of the logic of Mr. Hickenlooper and Mr. Forstall in having the time fixed at an earlier day than that named by the Committee, for the reason that any changes that are suggested here could be acted upon in case it was deemed desirable. I, therefore, do not myself object to April, but it brings the meetings of the two Associations almost together—one in April and the other in May—and it might be difficult for the superintendents or the engineers of gas companies to be absent two months in succession, and spend two weeks away from their work. Personally it makes very little difference to me, whether the time

be September or April. Whatever suits the majority of the members will be perfectly satisfactory to me. I am only anxious that we should fix upon a time that will be of the greatest service and convenience to the greatest number; and I presume the Western Association will readily accede to what the majority of the Association shall decide upon. To test the sense of the Association, therefore, I would suggest that we take a vote upon the amendments proposed.

MR. WOOD, of Syracuse—The members of the Association will remember that the proposed amendment did not originate with the Executive Committee at the present meeting, but is in accordance with a resolution which was passed a year ago providing for an amendment to that effect.

THE PRESIDENT—A resolution of that kind was submitted to the Association a year ago and was laid over.

MR WOOD—Yes; and the Executive Committee now recommend the adoption of that amendment to the Constitution. The time was fixed by the resolution submitted one year ago, whereas Mr. Denniston's objections to the month of May, on account of the meetings of the Western and Central New York Associations, have just been raised. If we should change the time of our meeting so as to conflict with theirs, we being the larger number, they would conform the time for their meeting to the time fixed by us for ours. I think the meeting of this Association should be fixed for a time when the greatest number could be present.

MR. SPENCER—I suppose that the question now before the Association is the adoption or rejection of the amendment to the Constitution proposed by the Executive Committee.

THE PRESIDENT—The amendment proposed by Mr. Denniston is now before us.

MR. SPENCER—Do I understand that a proposition to amend the Constitution must be presented at one meeting and acted upon at the next?

THE PRESIDENT—Yes, sir.

MR. SPENCER—Can such a proposition or resolution be amended? Must we not vote directly upon the amendment

proposed or recommended? It occurs to me that the question is narrowed to the adoption or rejection of the proposition as submitted by the Executive Committee. If so, I shall certainly vote against the adoption of the amendment for the reasons that have been named in regard to the meeting of the Western Association. That Association has been organized and the time of its meeting appointed with special reference to the date fixed for the meeting of this Association. I am a member of that Association, and also a member of this, though I have not attended many of its meetings. Knowing that the time of the meeting of the Western Association was fixed with special reference to the meeting of this Association, I should very much regret to see this Association fix the time of its annual meeting so near the time of the meeting of the Western Association. Again, in regard to the reasons assigned by Gen. Hickenlooper and Mr. Forstall for making the change, namely, that the gas companies may have an opportunity of availing themselves of any advantages to be derived from the meeting of this Association, it has occurred to me, that any suggestions that may be made here, anything we may learn here, will keep very well until the following season. If we have the meeting in October, as at present, and papers are presented and discussed which contain anything that we think would be valuable in our business, I think it would be well for us to consider them during the winter. We might, at the end of that time, arrive at a different conclusion, Or we might be able, after thinking the matter over carefully, to suggest some improvement. At any rate, I do not think there could be any harm in letting such suggestions lie over for a year, and a great deal of good might result from such a course. I am in favor, if we cannot amend this proposition as suggested by Mr. Denniston, of keeping the matter where it is, and rejecting the amendment proposed by the Executive Committee.

MR. LITTLEHALES—Is not the first question to be decided the question whether Mr. Denniston's amendment can now be entertained, or whether it will not have to lie over for another year? It seems to me that that question must first be passed upon before the Association can express its wish in regard to the matter.

THE PRESIDENT—Any amendment germane to the main proposition can be properly entertained, and any proposition simply to vary the date from one month to another is legitimate. That is the view I take of it.

MR. STARR—I heartily agree with Gen. Hickenlooper in regard to the time of meeting, if any change is made. If the time is fixed early in the spring, it will not conflict with the Western Association. September would be a disagreeable month on account of the heat, but October is a pleasant month, and so is May; but I think April would be better than May, for then there would be an interval of two or three weeks between our meeting and the meeting of the Western Association. For these reasons I prefer April.

THE PRESIDENT—I think it might be well to let this matter lie over until to-morrow. In the meantime the members of the Association can discuss it among themselves.

MR. CARTWRIGHT (Philadelphia)—I move that the question be laid on the table until to-morrow afternoon, and that it then be the first thing in order.

Carried.

THE SECRETARY—The next questton is upon the adoption of the recommendation of the Executive Committee that the salary of the Secretary be $300 per annum, with an allowance for expenses in attending the meetings not to exceed $100 on any one occasion, and I move its adoption.

MAJOR DRESSER—I do not think the recommendation for an allowance of $100 to the Secretary for travelling expenses to and from the annual meetings needs discussion. It seems to me that the justice of it is apparent. The salary of $300, the same as it has previously been, is very small.

The question was put and carried unanimously.

THE SECRETARY—The next recommendation of the Executive Committee is the appointment of a committee of three upon standards for comparison of results, to report at this meeting. I move its adoption, and that the committee be appointed by the Chair.

Carried.

The President—I will announce the names of the gentlemen to compose the committee this afternoon. That disposes of the business now before us in, regard to the recommendations of the Executive Committee.

Mr. Denniston—As the Committee have not suggested any hour for meeting, would it not be well to fix the hour for the meeting of the Association?

The Secretary—The hour for our meeting in the morning is fixed at 10 o'clock. It has been the custom hitherto to adjourn for lunch, and to fix the hour after that, as suits our convenience. It might be well for a motion to be made to adjourn for lunch.

The President—It is not worth while to hurry the proceedings. It is scarcely worth while to take up any paper previous to the adjonrnment, and there is nothing else now before us. I think that an hour spent in social intercourse and the shaking of hands would be very pleasant as well as profitable. It might be well, therefore, to adjourn now, and take up Mr. Forstall's paper immediately upon re-assembling this afternoon.

On motion of Mr. Cabot, the Association then adjourned until 2 P. M.

Afternoon Session—Oct. 13.

The Association met at 2 P. M., pursuant to adjournment, and was called to order by the President.

The President—We can proceed with a part of our regular business before Mr. Forstall commences to read his paper. The next thing in order will be the report of the Committee on the Nomination of Officers for the ensuing year.

Mr. Cartwright (Philadelphia)—The Committee on the Nomination of Officers beg leave to report the following for election for the coming year:

For President—W. H. Price, Cleveland, Ohio.

For Vice-Presidents—A. Hickenlooper, Cincinnati, Ohio; Theobald Forstall, New Orleans, La.; Wm. A. Steadman, Newport, R. I.

SECRETARY AND TREASURER—Wm. Henry White, New York City.

FINANCE COMMITTEE—John S. Chambers, Trenton, N. J.; A. B. Slater, Providence, R. I.; George S. Hookey, Augusta, Ga.

EXECUTIVE COMMITTEE—Henry Cartwright, Philadelphia., Pa.; F. C. Sherman, New Haven, Conn.; A. C. Wood, Syracuse, N. Y.; P. T. Burtis, Chicago, Ill.; T. Littlehales, Hamilton, Ont.; Samuel Prichitt, Nashville, Tenn.

THE SECRETARY—I move that the report of the Committee on the Nomination of Officers be accepted and the Committee discharged with thanks.

THE PRESIDENT—I wish to say, as my name stands at the head of the list of officers as submitted by the Committee, that, at the very outset, I did not think it would be there, and I did not think it ought to be there. I have been so many times in the Chair that I think it would be eminently proper that some one else should take this place. That is my personal feeling in regard to the matter now.

MR. DENNISTON—It is in order now for the Association to proceed to the election of officers, and I move that the Secretary be instructed to cast a ballot in behalf of the Association for the gentlemen named by the Committee.

Carried.

The Chair appointed Major Dresser teller. The Secretary then cast the ballot of the Association for the candidates named, and they were declared by Major Dresser to be unanimously elected. (Applause.)

THE PRESIDENT—So far as I am personally concerned, I thank you most sincerely, gentlemen of the Association, for the confidence in me that your action implies. Still, I feel precisely as I did before, that it would have been well to have made a change; but I submit to your decision. (Applause.)

I promised to appoint a Committee on Standard Weights and Measures immediately upon our resembling. I appoint Mr. Theobald Forstall, of New Orleans, La.; Mr. George Hookey, of Augusta, Ga.; Mr. A. B. Slater, of Providence, R. I.

The Secretary—Before Mr. Forstall begins the reading of his paper, I would state that the Executive Committee have, since the adjournment, received a communication from Mr. C. C. Anderson, superintendent of the Marquette, Michigan, Gas Works, in which he says—

"I send sample of aniline taken from coal tar. Not knowing its value, would be pleased to bring the matter before your body for its consideration."

I would state that the sample to which he refers has been received, and I would respectfully suggest that that sample be put in charge of Mr. Page, whose experience in such matters will enable him to give Mr. Anderson any information that will be of service to him.

Mr. Helme—I think it has been the custom in the past to invite the members of kindred societies, who happen to be in the city at the time of our meeting, to seats with us. If that has been omitted, I move that such invitation be extended now.

The President—I think it will be understood that members of any kindred association are invited to take seats in this room with us. If there are any members of such associations present, they will consider themselves invited to take seats with the members.

Mr. Forstall then read a paper.

ON STOPPAGES IN ASCENSION PIPES.

I must apologize at the outset, for taking up your time with a subject upon which so much has already been written that it would seem exhausted; but "out of the fulness of the heart the mouth speaketh," and when called upon by our Secretary for a paper I could think of nothing more interesting for discussion than the cause and prevention of an evil from which we have suffered much in New Orleans, and against which the remedies most effective elsewhere have failed in our works. Moreover, while studying what has hitherto been published on this subject, I found the various contributions so scattered in time and place, that I thought it might prove useful to gather together in one paper, the notes collected from English and French sourc

I shall first, then, review as concisely as possible the various opinions which have been offered as to the cause and prevention of stoppages in ascension pipes; secondly, describe our New Orleans experience, and, lastly, submit for discussion a theory of stoppages, suggested by that experience, in opposition to that generally entertained.

1.—*What has been Published about Stoppages.*

The proceeedings of the British Gas Managers Associatien contain several contributions devoted to our present subject. The first in time, as well as in value, is a paper read at the Dublin meeting, in June, 1871, by Mr. John Somerville, of Dublin. He therein attributes the stoppage of ascension pipes to the general accumulation of "the carbonaceous part of the condensation," which adheres to the surface of the pipes, when these have been overheated (1) by the higher temperature of the gas produced towards the end of the charge; (2) by transmission from the mouthpiece; and (3) by radiation from the brickwork of the bench. He refers to the various expedients adopted without much success to overcome or prevent them, viz.: wet coal, vessels of water, rock salt, soda, etc., placed in the mouthpiece, after charging, and iron shields interposed between the front wall of benches and the ascension pipes. He recommends, as conditions to prevent stoppages, (1) that the front wall of benches be not less than one and one-half bricks in thickness; (2) that mouthpieces be made not less fifteen inches deep, with a clear space of six inches between stand pipes and wall; (3) that the pipes be cast thin, not less than six inches in diameter; (4) that the hydraulic main be raised three feet above the top of the brickwork; and (5) that sheet-iron shields, four or five feet high, resting on each mouthpiece at an angle of 35°, be fitted to the bench to deflect from the pipes the flames which play about them at the time of drawing and charging. Finally he adds: "Doubtless, if ascension pipes were cast double, or having a jacket surrounding them, with a constant circulation of water or air from top to bottom, stopped pipes would be unknown; and also, if a piece of non-conducting material, a foot in length, attached to the

mouthpiece, and the ascension pipe leading from it, could be introduced at moderate expense, it would tend greatly to diminish the transmission of heat from one to the other."

Mr. Somerville, therefore, believed that stoppages were occasioned by excessive heat of the pipes, and that the cure lay in cooling them. How this object was to be assisted by enveloping the mouthpiece and lower portion of the stand pipe in non-conducting material is not clear. We shall see, as we proceed, that the assumption that the temperature of the gas in the ascension pipes is highest at the end of the charge, is disproved by the thermometer. The reverse is true.

At the Edinburgh meeting, in June, 1873, two papers were read upon this subject. Mr. Green, of Dartford, reasons upon the idea that stoppages are due to "particles of disintegrated carbon and other dry substances," which are made under very high heats, and are swept off and mingle with, and are carried along by the crude gas into the ascension pipes, where meeting the tar that slowly flows down the sides of the ascension pipe, it becomes thickened with this continuous process. The remedy which he proposes is a guard of woven wire with shelves, placed in the mouthpiece after charging. The gas issues through the close meshes of wire, and deposits on the shelves the solid particles of carbon.

Mr. Parlby, of Aylesburg, in his paper, gives four reasons for stopped pipes: (1) the heat of the coke at the end of the charge; (2) a large dip pipe seal; (3) flaws or defects in pipe castings; and (4) insufficient size of hydraulic main. His remedies are: "an uniform temperature in the retorts, say, a good white heat," "mouthpieces kept clear of carbonaceous or tarry matter," and "heavy charges in the hottest retorts."

The subject came up before the British Managers again in 1874, when Mr. Hodgson Jones, of London, described and recommended Vincent's Patent Gratings, which appear to be merely a modification of Green's wire screens.

Our Scottish brethren now follow in order. Mr. Malam, of Dumfries, describes at the Glasgow Meeting of the North British GasManagers, in June, 1874, an adaptation and extension of Mr. Somerville's suggestion for cooling the ascension

pipes with water. The chief cause of stoppages in the ascension and other pipes, he says, is "as we all well know, the adhesion to the inside of the pipes of the highly decomposed hydrocarbons which are carried forward by the gas." His patented preventive is "a trough formed on the mouthpiece, embracing the lower end of the ascension pipe, which is kept constantly filled with water supplied by a circle of jets at the top of the ascension pipe flowing down the outside. Additional assistance is afforded by a continuous spray of water down the interior of the ascension pipe and through the mouthpiece.

The West of Scotland Gas Managers heard a paper from Mr. Martin, of Kilmakolm. He tersely says: "I am of opinion that it is the tar in the hydraulic main which is the actual and immediate cause of choked ascension pipes;" and his preventive consists in running out the tar from the bottom of the hydraulic main, after every charge, allowing the dips to be sealed with ammoniacal liquor only.

Crossing the Channel, we find the French gas engineers taking up this question where the English have left it.

M. Rouget, of Brest, gives his experience in an interesting communication at the meeting in May, 1876. The stoppages in his works occurred in the longest as well as in the shortest ascension pipes, wherever the retorts are the hottest. He attributes them to the distillation of the tar flowing down the sides of the pipes, by the heat of the issuing gas, thus forming successive layers of pitch. He found relief, but not immunity, by surrounding several ascension pipes with non-conducting material. The effect was to prevent internal cooling, and thus to alter the characteristics of the adherent obstruction. Instead of tough, vicious pitch, the pipes were now filled with a dry, granular substance, easily removed. This relief was apparent only, however, as the bridge and dip pipes soon distllled the tar, and in their turn became stopped with tough pitch. An attempt was then made to cool the bridge and dip pipes by jets of water, but this was found to be difficult and ineffective, and was given up.

At the same meeting, M. Bremond, of Versailles, whose name has since become familiar to us in connection with his

paper on "Naphthaline," gave further valuable testimony from his experience as to the effect upon stoppages of confining the heat in the ascension pipes. In the Vaugirard station of the Paris Gas Company, M. Letreust, the engineer, had applied to a number of benches an anti-refrigerating" treatment, of his invention. All the mouthpieces, and the ascension pipes as far up as the brickwork extended, were built into and covered by the front wall of the benches, and the mouthpieces were fitted with double doors to prevent radiation. Stopped pipes were frequent; but the stoppages occurred mostly just at the point where the ascension pipes emerged from their hot bed. By extending the non-conducting coat as far as the dip pipes the stoppages were transferred to the inside of the hydraulic main. M. Bremond concurs in the opinion of Mr. Somerville, which he quotes, regarding the prevention of stoppages by the use of double or jacketed ascension pipes cooled by currents of air or water, and concludes as follows:

"It is my opinion that to overcome the obstruction of stand, bridge, and dip pipes, we should suddenly cool the gas as it issues from the retort, facilitate its flow by pipes of large section, remove the seal from the dip pipes during the distillation of the charge, and lastly, cool energetically the hydraulic main, in which the liquid should be changed as frequently as possible."

At the Paris meeting in June, 1878, M. Rouget presented a supplementary communication, in which he claims to have at last found means to apply easily to the ascension pipes the principle of rapid cooling. He substitutes for the thin ascension pipe ordinarily adopted, a pipe two or three inches in thickness, the outer circumference of which it deeply dentated to increase the radiating service. He asserts that by the use of these new pipes the temperature has been lowered internally 105° Cent. (221°F.) during the passage of the gas from the mouthpiece through a distance of five feet six inches only; while in ordinary pipes, upon corresponding retorts, the loss of heat under similar circumstances was but 14° Cent. (58°F.). In the discussion on this paper, one member asserted that he had prevented stoppages by the use of sheet iron ascension

pipes, reaching thereby, more naturally, the same result. Mr. Gil, of Barcelona, contended, on the other hand, that the cooling of ascension pipes tends to produce stoppages. He himself had tried a jet of cold air blown through a tube against a series of ascension pipes, and every pipe operated upon had been choked. Mr. Ellissen said that a steady flow of water through the hydraulic main was the most certain and simple preventive of stoppages.

Returning now to our own shores I find, in the *American Gas Light Journal*, Feb. 2d, 1880, a letter from Mr. Egner, of Norfolk, advising the use of a jet of steam in the stand pipe, and, finally, the interesting paper of Mr. W. A. Wood, of Syracuse, read before the Central New York Gas Engineers Association last February. This is, doubtless, familiar to all of us, and you will remember how graphically he describes the conversion of his retort house from a pandemonium into a Quaker meeting house, by the saving grace of water immersion—I should say injections in his ascension pipes.

Alas! we, in New Orleans, added prayer to the water, but conversion did not follow.

2.—*Stoppages in the New Orleans Gas Works.*

The evil made its appearance in our works in 1871, with the use of high heats and large yield. Our retorts were small D's, 12×20 inches, in benches of five, carbonizing 1100 and 1150 pounds of Pittsburg coal in four hours, and fitted with 4 inch stand, bridge and dip pipes. The hydraulic main was circular and small, only 16 inches in diameter. During the four years that we continued to run these settings, stoppages were occasional only, mostly in the stand pipes, rarely in the bridge, and not a single case recorded in a dip pipe. The tar in the hydraulic main remained fluid and flowed off easily. In 1875 the works were remodelled. Large retorts, 14×25 inches, in benches of six, were erected. The four hour charge was increased to 1600 and 1650, (266 lbs. and 275 lbs. per retort); the stand and bridge pipes were enlarged to 6 inches, but the dip pipes inside the hydraulic main were contracted to four inches. This contraction of the dip pipe, in the light of

subsequent stoppages there, was possibly a mistake. Its object was to avoid unduly increasing the weight and dimensions of the hydraulic main.

The retort house is 245 feet long, with a clear width of 62 feet. To secure free ventilation during our tropical summers, the long sides of the building are not enclosed by walls, the roof being born upon two lines of iron columns 26 feet in height. Forty-eight benches extend in line, twenty-four on each side, back to back, and fronting north and south respectively. The south benches are protected from driving storms and cold winds by rolling shutters fitted between the columns. The north benches are shielded by the coal shed, the roof of which is supported by the retort house columns on that side. The bench settings are all alike, and the manipulation is the same on both sides of the house.

From the beginning, the stoppages were more frequent on the new than on the old benches, and they have since increased from winter to winter, until we were compelled, last season, to detail two men day and night to the special work of clearing out the worst pipes. During a period of ninety days from December to March there were 1605 separate, distinct and complete stoppages in the stand, bridge and dip pipes of twelve retorts. In spite of every remedy, this state of things continned until May, when the stoppages, as usual, gradually ceased for the summer, to return when cold weather sets in.

A daily record of every stoppage has been kept for more than two years, and many careful thermometrical observations of the temperature in the pipes have been made from time to time by Mr. Carroll, the manager of the works. These records show that the stoppages occur almost exclusively in the pipes of the two upper retorts, and are many times more frequent on the north than on the south side benches; but while this latter condition was constant with regard to the aggregate number of benches under fire, it was found that certain pipes on the south side would be stopped as frequently as the worst on the north side; while, on the other hand, certain north side pipes remained as clear as the freest on the

south side. The stoppages extend even into the hydraulic main, which is seldom free from thick, semi-solid pitch.

The following table shows the stoppages on twenty benches during December and January last. The odd numbers are north, and the even numbers south side benches. Number 25 backs 26, No. 27 backs 28, and so on, to the end of the range:

Table A.

North Side Benches.	1879–80 Dec. & Jan. Days in Action.	Number of Stopped Pipes. Stand.	Bridge.	Dips.	Total.
25	62	5	14	2	21
27	62	0	0	0	0
29	62	0	0	0	0
31	62	0	2	3	5
33	61	72	88	42	202
35	61	82	94	47	223
37	60	96	99	49	244
39	61	43	47	16	106
41	62	75	90	36	201
43	60	29	41	16	86
		402	475	211	1088
South Side Benches.					
26	61	4	12	3	19
28	61	0	2	0	2
30	61	0	0	0	0
32	61	0	0	0	0
34	60	5	7	3	15
36	60	4	5	3	12
38	59	1	3	1	5
40	61	11	13	0	24
42	61	30	34	10	47
44	58	39	45	18	102
		94	121	38	253

It will be here seen that 1088 stoppages occurred in 62 days on the ten north side benches; of these 402 were in the stand, 475 in the bridge, and 211 in the dip pipes. The ten adjoining south benches scored but 253 stoppages in the same time, less than one-fourth the number. The exceptional benches are Nos. 40, 42 and 44, with 24, 74 and 102 stoppages, respec-

tively, on the favored side; while Nos. 27, 29 and 31 on the north side were as free as any of the south side benches. Thus, alongside of the general fact pointing to the influence of atmospheric changes from prevailing winds, arose perplexing, anomalous exceptions, which complicate the problem. Again, periodical changes occur of weeks or months. Benches free from stoppages will suddenly fall into line with high scores for several weeks, and then as suddenly drop out again. Thus, benches 27 and 29 were free throughout December, January and February, but scored 69 and 59 stoppages, respectively, during March and April. On May 12, 1879, when every bench had been free for weeks, all the bridge and dip pipes of the upper retorts were stopped on the north side of the house, and, on the next day, all the corresponding pipes on the south side were similarly stopped. There were no stoppages for weeks afterwards. During all the time covered by these records, the coal used has been from the same mines, the heats have been fairly uniform, and the firing and charging done by the same men.

[See Table *B*, page 242.]

The next table exhibits the comparative number of stoppages in each of 12 benches during the time when they were actually under fire, in the seasons of 1878, 1879 and 1880. The north and south adjacent benches are paired to make plainer the difference between them.

The general rule of south side exemption is here shown to be constant, as well as the fact that the south is not quite solid, as bench No. 44 scores 96 stoppages in 82 days.

The observations taken of the temperature in the ascension pipes during progressive phases of the distillation, furnished no clue to the cause of the immunity enjoyed by the lower retorts of every bench, and by all the retorts of some benches, while in their immediate neighbors, the habit of stopping was most strongly developed. With equal charges and heats the temperature in all the ascensions pipes of a given bench varies but slightly at the same distance from the mouthpiece, and at the same period of distillation. From a great number of tests, between which a remarkable conformity exists,

the mean temperatures are here given. In the tables, No. 1 is always the lower, No. 2 the middle, and Nos, 3 and 4 the upper retorts. In all the observations the bulb of the thermometer was exposed in the center of the pipe, and the tube carefully insulated from the metal.

[See Table *C*, page 243.]

Four facts may be noted in connection with these figures.

First, that the temperature is at a maximum just after the retort has been charged, and then constantly falls to the end of the distillation, reversing the conditions which exist in the retort itself.

Second, that from the moment the gas enters the ascension pipe the loss of heat is very rapid along its whole length.

Third, that towards the end of the distillation, the temperature in the bridge pipes is lower than that of the mixed gas in the hydraulic main.

Fourth, that an increase in the weight of the charge raises the mean temperature of the ascension pipes during the whole period of distillation.

The mean temperatures in the bridge pipes of four adjacent benches, of which two were north and two south, with normal charges, are given in the next table. Of these benches all but No. 36 were persistently obstructed, yet the temperature in No. 3 ascension pipe of that bench is higher than in the corresponding pipes of benches Nos. 43 and 44, and the initial temperatures at the bridge, only one degree lower than in the same pipe of No. 35.

[See Table *D*, page 244.]

Table B.—Stoppages in Twelve Benches, 1878 *to* 1880.

Benches.	1878.		1879.		1880.		Totals.
	No. of Days in Action.	No. of Stoppages.	No. of Days in Action.	No. of Stoppages.	No. of Days in Action.	No. of Stoppages.	
No. 27, North.	145	47	243	40	177	110	197
No. 28, South.	148	4	234	5	190	2	11
No. 29, North.	145	45	218	50	195	140	235
No. 30, South.	144	9	220	22	196	48	79
No. 31, North.	144	56	197	49	202	131	236
No. 32, South.	143	13	187	3	203	8	24
No. 33, North.	98	66	138	135	209	278	479
No. 34, South.	130	0	154	5	206	42	47
No. 35, North.	76	30	112	140	160	386	556
No. 36, South.	76	0	103	12	165	8	20
No. 43, North.	......	......	44	56	37	49	105
No. 44, South.	......	......	44	27	38	69	96

Table C.—Mean Temperature in Ascension Pipes During Distillation.

Charge, 266 pounds, 4 hours. Bench No. 37.	Time of Observation after Charging.								Mean of 3½ H.
	5 M.	30 M.	1 H.	1½ H.	2 H.	2½ H.	3 H.	3½ H.	
At 7 feet 9 inches above mouthpiece—	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	
Retort No. 3	455	446	406	365	303	257	198	180	326.2
Retort No. 2	469	459	428	388	327	286	235	194	348.2
Retort No. 1	451	437	412	371	322	280	216	180	333.6
									Mean of 3 H.
At 12 feet 10 inches above mouthpiece—									
Retort No. 3	325	318	286	257	246	199	167	....	256.8
Retort No. 2	318	302	284	266	226	196	167	....	251.2
Retort No. 1	300	289	273	257	237	216	198	......	252.8
									Mean of 3½ H.
At bridge pipes—									
12 feet 10 inches from mouthpiece of No. 3	320	306	291	268	232	198	158	127	237.5
14 feet 10 inches from mouthpiece of No. 2	302	293	261	216	183	160	142	129	210.7
16 feet 10 inches from mouthpiece of No. 1	268	252	219	190	165	145	133	122	186.7
17 feet 10 inches from mouthpiece of No. 4	252	228	210	187	167	145	131	118	179.7
At 7 feet 9 inches above mouthpiece—									
Retort No. 3, 331 pounds coal	414	392	374	320	316	309	275	239	330.0
Retort No. 2, 254 pounds coal	406	385	379	338	309	275	221	181	312.0
Retort No. 1, 254 pounds coal	390	383	383	334	275	244	198	165	296.6
Retort No. 3, 201 pounds coal	433	421	347	284	261	221	185	154	288.3
Retort No. 2, 279 pounds coal	468	448	428	381	378	325	277	261	370.6
Retort No. 1, 279 pounds coal	459	432	405	365	349	306	262	228	350.6

Table D.—Temperature in Ascension Pipes During Distillation.

Charge, 266 pounds; 4 hours. At bridge pipes.	Time of Observation after Charging.								Mean of 3½ H.
	5 M.	30 M.	1 H.	1½ H.	2 H.	2½ H.	3 H.	3½ H.	
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
Bench No. 35—									
Retort No. 3	337	326	313	295	268	236	206	185	277.4
Retort No. 2	293	273	259	234	207	181	157	144	224.3
Retort No. 1	267	244	229	206	181	160	146	135	200.0
Bench No. 36—									
Retort No. 3	336	325	300	272	241	204	170	151	250.0
Retort No. 2	317	298	278	254	230	199	171	149	236.7
Retort No. 1	289	264	248	229	206	185	157	138	214.0
Bench No. 43—									
Retort No. 3	325	309	285	258	229	207	181	151	243.0
Retort No. 2	316	300	279	252	225	197	172	146	239.0
Retort No. 1	294	271	250	227	203	172	149	137	212.7
Bench No. 44—									
Retort No. 3	349	319	291	261	221	192	165	138	241.8
Retort No. 2	345	324	310	281	249	215	180	146	255.6
Retort No. 1	309	286	267	244	211	181	160	137	224.2

To complete these observations by data from other sources, I copy from the London *Journal of Gas Lighting*, of June 4th, 1878, one of a series of three tests published by Mr. T. A. Collinge, Gas Analyst to the Corporation of Manchester.

These temperatures are all lower at equal distances from the mouthpiece than those found in our works, and they also differ in this, that the maximum is not reached until one or two hours after charging. Lower retort heats will account for these discrepancies in the English results; and the free distilling qualities of the Pittsburgh coals, compared with the more refractory French coals, will explain them in the Brest series.

Temperature in Ascension Pipes, Manchester Gas Works.

Charge, 280 pounds, in 6 hours. Wigan Arley Coal.	Time of Observation after Charging.					
	5 M.	1 H.	2 H.	3 H.	4 H.	5 H.
	Deg.	Deg. high'r than	Deg. high'r than	Deg. high'r than	Deg.	Deg.
At 3 feet above mouthpiece.........	320	640	640	640	380	380
At middle of pipe....	210	360	378	380	220	196
At top of pipe.....................	160	199	200	199	120	115

From the same *Journal*, May 28th, 1878, the following observations, by Mr. Charles Hunt, of Birmingham, are taken—

Temperature in Ascension Pipes, Birmingham Gas Works.

Charge, 253 pounds. Six hours.	Time of Observation after Charging.							
	5 M.	30 M.	1 H.	1½ H.	2 H.	2½ H.	3½ H.	6 H.
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
18 inches above mouthpiece	248	260	270	274	280	290	282	280
4 feet 6 inches above mouthpiece..	154	168	164	150	140	135	125	115

Finally, I must add the following series, determined from curves of temperature accompanying M. Rouget's last paper before referred to. I have selected the hottest retort.

Temperature in Aseension Pipes, Brest Gas Works.

Charge, 4 hours. Weight not given.	Time of Observation after Charging.						
	0 M.	30 M.	1 H.	1½ H.	2 H.	2½ H.	3 H.
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
6 inches above mouthpiece....	482	509	542	500	473	392	377
6 feet above mouthpiece.......	212	221	190	180	169	140	122

Summing up, now, the facts of our New Orleans experience we find:

1st. Constant freedom from stoppages in the pipes of four retorts out of six in every bench, under similar conditions of heat, charges and temperature in all the pipes.

2d. Complete immunity of every retort in certain benches on both sides of the range, while the upper retorts of neighboring benches are frequently stopped.

3d. Comparative freedom from stoppages of south side benches.

4th Great frequency of stoppages in winter and cessation in summer.

The remedies which we have tried exhaust, I think, the whole stock of specifics proposed to cure the evil, except Mr. Malam's elaborate arrangement. The list is a long one.

1. The catch shield or diaphragm in the mouthpiece.

2. External application of water in jets to the surface of the ascension pipes, as patented by Mr. Shiras, of Sharon, Pa.

3. Water jackets through which a constant flow is maintained.

4. Steam jets, large and small, constant and intermittent above, below and at mid-height of stand pipes.

5. Internal water jets, as practiced by Mr. Wood, until the cooling effect cracked several mouthpieces, and the water lay on the mouthpiece floor.

6. Extra weights of coal in retorts. This was effective only by lowering the heats and greatly reducing the yield of gas.

7. Lengthening the ascension pipe five feet. This brought down the temperature in the bridge pipe to 252° at the beginning of the charge; but a stoppage in the bridge pipe immediately followed the change.

8. A thin wrought iron stand pipe was tried; but on the fourth day it became so completely choked that it could not be cleaned, and it was taken down.

None of these remedies afforded desirable relief, although carefully, patiently and preservingly applied.

3.—*What is the True Cause of the Stoppages.*

Before discussing the conflicting theories of the genesis of stoppages, we must discriminate between them. The hydrocarbons which obstruct the pipes very greatly in their physical properties under different circumstances and in different parts of the same pipe. They may be divided into three categories: (1) Hard, stratified, graphite-like material, adhering closely to the whole interior surface of the stand pipe proper. This accumulates principally above the highest point reached by the clearing auger used regularly between the charges, and forms the most difficult obstruction to remove. (2) Thick, pasty, tough pitch, which balls together under the tools and drops out in large lumps. This is the most frequent obstruction in our works, and is formed equally in stand, bridge and dip pipes, and even the hydraulic main. (3) Dry soot or granular lamp black. The stoppages from this material are sudden. and rapidly become total. They occur a short time after the retorts are charged, and may extend as far as the dip pipe, They are very easily removed. Sometimes all three of these characteristic products are found in the same pipe; but, generally, the nature of the stoppage is determined by the predominance of one or the other of them.

It is agreed on all hands that stoppages of any kind occur only when the retorts are highly heated. The first cause, therefore, is in the retort efficiency, and only with the secondary causes must we deal. We can also dismiss from further

consideration the dry obstructions of soot, as this substance, when once produced in the retort, is not amenable to change, and must be dropped somewhere in the pipes, unless we trap it in the mouthpiece, on screens and gratings.

The first and second class of stoppages, to which alone preventive treatment outside of the retorts can be applied, may be discussed together. The opinion generally held, as expressed in the papers reviewed, is that they are produced in consequence of the excessive heat in the ascension pipes, by distillation into pitch of the condensed tar which flows down their surface, until successive layers close the pipes. There are two theories of the source of the heat by which this distilling process is performed. Messrs. Somerville, Malam, Bremond and others believe that it is in the metal pipe itself, while M. Rouget asserts that the heat which cooks the tar is that of the ascending stream of gas and vapors. The distinction is important, for the temperature of the pipes does not rise to the high degree reached by the current inside of them, except possibly just at the mouthpiece. At the height of seven feet nine inches from the mouth piece, we found the dfference, at progressive periods of the charge, to be as follows:

Time after charging.	5 m.	30 m.	1 h.	1 h. 30 m.	2 h.	2 h. 30 m.	3 h.	3 h. 30 m.	4 h.
Temp't're of pipe	176°	225°	241°	234°	219°	180°	163°	158°	153°
" inside of "	469°	459°	428°	388°	327°	286°	235°	194°	

From this it appears that the ascension pipe gradually becomes heated by the ascending products of distillation from the retorts, reaching its maximum temperature an hour after charging, then steadily grows cooler to the end of the charge.

If the production of stoppages be due to excessive heat in the ascension pipes, the source of the heat must, therefore, be the up-rushing vapors themselves. The theory then, if true, would explain and account for stratified stoppages only, of the first class, occurring in the stand pipe proper, where the heat might be sufficient to distill such material. And if such be the only cause then would all stoppages be of that character and limited extent. Every ascension pipe, under approximately equal conditions, would possess the same tendency to stoppage; for this formation of pitch from tar on the surface of the pipe would be a mere question of time in any bench

with tolerable heats. But we are told that in Paris, when the heat was confined in the mouthpieces and ascension pipes as far as the hydraulic main, no stoppages took place in them, but that pitch was formed in the main. In New Orleans, as I have said, we have very few stoppages in summer, when the pipes are hottest, and in winter they are much less frequent on the south side benches; while there is perfect immunity in the four ascension pipes of every bench that are most exposed to the radiation from the brickwork, and the internal temperature of which is as high as that of the two which become stopped.

From these considerations I am tempted to believe that the reverse of this theory is true; that, instead of excessive heat, it is the comparative coldness ot the ascension pipes which determines the formation of these obstructions in them.

It appears to me probable that, under certain conditions of coal and high retort heats, a series of hydrocarbon vapors may be produced in the early stages of the distillation which solidify upon contact with the relatively cool surface of the ascension pipes; and, further, that in order to effectually prevent stoppages from this cause, these vapors must be completly intercepted in the mouthpiece itself. This could be effected by cooling the mouthpiece to that point only which will determine the condensation within it, in a liquid form, of all vapors which solidify on their passage to the hydraulic main; but, at the same time, leaving the ascension pipes to retain their normal heat, so as to allow the greater portion of the tar vapors to pass over to the hydraulic main. Perforated diaphragms or gratings in the mouthpieces would assist in this condensing process, as well as entrap the soot deposit.

I present this theory with diffidence, as it has occurred to me only since I have grouped together the materials of this paper, and I have as yet had no opportunity to put it to the test of actual practice; but I think the Paris results with hot ascension pipes conclusive against the opposite doctrine, while, taken in connection with the failure of cooling ascension pipes in our works, they go very far towards confirming the view just advanced. On this assumption it would follow that the

partial relief afforded by such remedies as vessels of water, wet breeze, wire screens, etc., is not complete; because, although right in principle, they but imperfectly fulfill the end of condensing the obstruction-producing vapors, while the great benefits which in many cases have followed the cooling treatment applied to the ascension pipes, have been the consequence of a simultaneous and indirectly produced cooling of the mouthpiece itself sufficient to accomplish the result.

In our own case the various cooling appliances to the ascension pipes produced rather an aggravation of the stoppages; but their influence did not reach down to the mouthpiece, except when internal water jets were used, and in that instance the cooling effect upon the mouthpiece was confined to its floor, upon which the water dropped directly from the stand pipe. If any member of the Association has a knowledge of any facts which will tend either to confirm this view, or to explain away the apparent contradiction involved in the theory herein controverted, I shall be glad that I have brought up the subject, even while I crave your forgiveness for having taken up with it so much of your time.

The reading of the paper was greeted with applause.

Discussion.

THE PRESIDENT—It is not necessary, I am sure, for me to say that the paper to which we have just listened is a most able and interesting one. It invites the most careful scrutiny and the most thorough discussion. I hope every member who has anything to say upon the subject so ably presented by Mr. Forstall will not hesitate to express his views. Perhaps Mr. Wood will give us the benefit of his experience.

MR. WOOD, of Syracuse—I do not claim any prestige over anyone else who has anything to say upon this subject. Mr. Forstall has alluded to a paper that my son read upon this question before the Central New York Gas Light Association, which paper has been published with the proceedings of that Association in the *American Gas Light Journal*. The paper was written some five or six, or, perhaps, seven months after we began the use of the internal application of water to

the stand pipes. For the succeeding twelve months since that time our experience has been as related in that paper. Instead of having 1005 stoppages of stand pipes in sixty days, we have not had five stoppages of the stand pipes within this whole time. I think the great trouble with Mr. Forstall was that he used too much water. It only requires a very little—just the continuous dropping of water.

MR. FORSTALL—We graduated that very carefully. We began with a little, and increased the quantity gradually.

MR. WOOD—That has been our experience in relation to this process. We have no stoppages of stand pipes. We do not know what it is in our works. We have had no broken mouthpieces, no broken stand pipes, or any results of that kind. Care is taken after the charge is drawn from the retort, and before putting in another charge to clean out the mouth of the stand pipe. We have a tool made expressly for that purpose, as related in the paper, which the members of the Association will probably remember. It is at that point only that there is any stoppage—just as the stand pipe leaves the mouth-piece. The round tool that we use just fits the internal diameter of the mouth of the stand pipe. It is circular in form. With that tool we clean out the mouthpiece before putting in the charge.

If that is done I do not think you will have a single stand pipe stopped in your retort house.

We run our heats as high as possible. Our retorts are all one size, 12×24, or, more correctly speaking, 12×23. We endeavor to get the retort makers to make them 12×24 internal diameter; but it is almost impossible to get them to put on the extra inch. For some reason or other they insist upon making them 12×23. The retorts are nine feet long. We burn in these retorts from 1,600 to 2,000 pounds of coal every twenty-four hours. In the bench of retorts we are now running, we added on the half brick to the front of the bench, as described by Mr. Forstall, making it a brick and a half, and leaving half an inch air space.

The stand pipes and the bridge pipes are cooler, by reason of that additional half brick and the air space between. If

Mr. Forstall will carefully read over the paper that my son wrote at that time, describing our experience, he will find very great relief. We have tried the increased thickness of the wall of the front bench, and have also put up shields of iron plates. If he will introduce on the inside only that small quantity of water that I referred to—just a continuous dropping—he will find that the water, converted into steam, keeps the whole thing moist. The dry carbon that he complains of is so moist that he will find it there as I have stated. The moment he slacks off the lid he will find that the water is still dropping down in the mouthpiece a little. Our experience has been continued for twelve months after we commenced using the process. I do not think we have had five stand pipes stopped during the whole time we have used the water. Before that there was, as my son and Mr. Forstall have described, a continuous stopping of stand pipes.

I do not think we have had the experience of the difference in the stoppage of the stand pipes in summer and winter that Mr. Forstall speaks of. I think we had it just as much in the summer time, running down sometimes to 18 in the summer time, and up to 48 or 54 in the winter, and 60, at times. I should recommend Mr. Forstall to read over the paper carefully, and follow the process therein described. If he does, I think he will find, as we did, great relief.

MR. STARR—What is the size of your stand pipes?

MR. WOOD—Six inches. The mouthpieces are 12×20. New mouthpieces that I am just putting in are 12×24. We have had, during this time, a few stoppages in the bridge pipe. Previous to using the water inside of the pipe we had them very frequently; then they would be as often in the bridge pipe as in the stand pipes.

You will find, in this application of water, that there will be a collection of this dry carbon which will, perhaps, be down all around on the inside of the mouthpiece just where the stand pipe comes out. With this round tool that I have described, just fitted to the inside diameter of the stand pipe, you clean that out well. It seems to collect at that point. I presume, from that, that the water evaporates or turns into

steam before it gets down to that point. It would be below the hub of the mouthpiece, close down to it, and there it would be at times pretty hard, but not hard enough to shut off the mouthpiece entirely, so as to necessitate slacking off the lid to clear it away. I do not think, within the last nineteen or twenty months, we have had five stoppages of stand pipes in our works.

MR. FORSTALL—I hope that Mr. Wood does not think that I doubt at all ; but that the result in his works has been precisely as he has stated.

MR. WOOD—Not at all.

MR. FORSTALL—I merely believe that the good results in his works were brought about, not by cooling the stand pipe, but that, indirectly, by cooling the ascension pipe, he cooled the mouthpiece, and that the cooling or non-cooling of the ascension pipes had nothing to do, directly, with the result.

The experiment, in our works, has been tried exactly as he tried it. We had used these water jets after a fashion of our own. After reading the paper published in the *Gas Light Journal*, I took pains, in order that there might be no question as to the manner in which the water had been applied, to exactly follow Mr. Wood's directions. The tool that he mentions we have been using for years. It is a circular chisel which fits exactly the bore of the pipe. I can assure you that the failure in our case has not resulted from any careless use of the prescription. I did what I always do when I call in a physician—exactly what I was told to do. But in this case the symptoms were not at all relieved. I attribute this failure to the fact that possibly our heats approach the mouthpiece a little nearer than they do in his works. Our mouthpieces are rather shallow. There is very little space between the stand pipe and the brick work. So, I suppose, that in our case the indirect action upon the mouthpiece was not sufficient. It was then that I tried the experiment of turning on more water. The consequence was that the bridge pipes and the dip pipes were stopped ; also that portion of the ascension pipe directly above the jet of water. I should like to know whether Mr. Wood has any stoppages in the dip pipes in his works.

[illegible]

[illegible] have any pitch in your hydraulic [illegible]

[illegible]

[illegible]—[illegible] thick tar and often even [illegible] above the [illegible].

[illegible]—[illegible] three feet above the bench. [illegible] It rarely gets [illegible] thick tar; it troubles us [illegible] the tar well. We have no [illegible] dip pipe. I suppose [illegible] get quite down to the [illegible] we put in there is evapor- [illegible] reaches the mouthpiece. I [illegible] is found imme- [illegible] pipe. It is enough to [illegible] when we knock the lid off there [illegible] tar running down the [illegible].

MR. [illegible]—[illegible] of the stoppage [illegible]

MR. [illegible]—[illegible] carbon, burned on [illegible] the stand pipe. [illegible] depth— [illegible] inches.

THE PRESIDENT—[illegible] coals may help [illegible]

MR. [illegible]—[illegible] Pittsburg coal.

MR. [illegible]—[illegible] Westmoreland Pitts- burg coal.

THE PRESIDENT—I [illegible] remark because we attempted to use a certain [illegible] perhaps, might prove to be good gas coal. We knew it was rich in gas, and we thought it might turn out to be very good and very cheap; but in- stead of distilling tar it distilled pitch. It stopped everything.

We were obliged to stop using it, because it stopped us. It may be that sometimes the difficulty you speak of arises from the use of coal that in itself has a tendency to produce pitch. I thought it might help matters some if you came to an understanding as to the kind of coal you used.

MR. WOOD—We are both using about the same kind of coal. Mr. Forstall speaks about the heat coming out of the front of the bench. The setting that we use is an open setting, one of our own device, and, perhaps, a little peculiar to ourselves, but not differing very much from the ordinary open setting. With that setting we heat our retorts well up to the mouthpiece. It was quite a relief to the men from the heat in charging, especially in the summer time, when I added that brick and the half inch air space. Our benches are well heated out to the front, and with our setting we could not observe any difference in the stand pipes as between the lower and upper retorts. We did not have the experience that Mr. Forstall relates. Our retorts face to the east, and that may make a difference.

MR. FORSTALL—The prevailing wind may have something to do with it, as well as the direction in which the retorts face. We have an extra thickness of wall, thirteen and a half inches, but we have not put in sheet iron between the brickwork and the stand pipe. That may help to prevent radiation to the mouthpiece. When I spoke of heat coming forward on the mouthpiece I had reference to radiation. In your case you may have kept your mouthpiece cooler by preventing the transmission of heat from your brickwork. The ascension pipes that we have are fourteen feet ten inches long. We have added several feet to their original length, and have since that kept down the heat of the pipes.

MR. WOOD—There is one thing that has aided somewhat in keeping the thick tar or pitch from our main, and, perhaps, from our bridge and dip pipes. I do not know what the experience of others may have been in that direction, but in re-setting our benches (we have two sets of seven benches each) we use up one bench entirely, or calculate to, before repairing it. At that time we take off the end plates from the main, and

the stoppers out of the stand, bridge and dip pipes, and give them a thorough cleaning.

Mr. Forstall—We do that every Sunday. We clean out our hydraulic main from one end to the other, and we clean out every stand, bridge and dip pipe regularly. The Sunday work of cleaning out these stoppages is not included in the figures which I have given. It is only the stoppages between times that I have made a record of here. In the old retort house the hydraulic main was laid close to the brick work, and the coarse cinders were almost on a level with it. The bricks were almost red hot, and it was impossible for a man to walk on them; but the main was free from pitch. There was no thick tar in the main, nor a stopped bridge pipe, nor a stopped dip pipe, nor delay on account of a stopped ascension pipe, and it is possible that, in that direction, we may find the cause of the stoppages.

Mr. Wood—We have, perhaps, a greater thickness of brick work on top of our retorts, and between them and the hydraulic main, than that. It is seldom that they are red hot. They never get so hot as Mr. Forstall stated his did.

Mr. Forstall—Those were the old benches. in our new benches we have three feet of brick work above our retorts, and a man can walk on the brick without any inconvenience at all.

Mr. Ludlam—I would like to ask Mr. Forstall if he ever tried putting in a vessel of water in the mouthpiece. I have heard of that being done.

Mr. Forstall—Yes; as far back as 1871 we used a patent lid, invented by Mr. Jones, of South Boston. It was a casting with a cup on the inside for holding water. In those days our stoppages were so few that it was no object for us to adopt any special means for preventing them. After we made changes in our retort house, we tried a similar plan, but we did not find relief from it. We have tried all sorts of vessels, from one gallon up to five, but have derived no apparent benefit from them. The trouble was that wherever there was any benefit immediately due to the use of water, the stoppages would all

take place beyond the point where it would be effective. In some cases it is quite possible that a vessel of water will do good, and afford relief, but it did not in our case.

MR. STARR—Would not the difficulty be obviated by the use of large stand pipes? In my own case I first put in four-inch stand and bridge pipes. They used to stop frequently, and I had a great deal of trouble with them. Sometimes we had to take off the lid and clean them out, and sometimes we had to burn them out. The next season I put in seven-inch stand pipes, and after that we had very little trouble. We are now using eight-inch stand pipes and seven-inch dip pipes, and they have not been stopped more than. perhaps, two or three times in two or three years. Two or three years ago I was considerably alarmed at the position I found myself placed in. I found my hydraulic main filled to the top with pitch. I did not know what to do with it. Finally, I took it all out and built a loose wall of brick along the top of the bench, underneath the hydraulic main, and about one foot above the bench. I filled it with these clay cinders that Mr. Forstall speaks of being on top of the bench clear up to the main. I have never had any pitch in my hydraulic main since. Mr. Wood speaks of cleaning the bottom of the stand pipe with an instrument made for that purpose. I never charge my retorts without using it. If there is any accumulation of dry carbon there, which there seldom is, it is but a moment's work to clear it away. We do not have anything above five inches from the mouthpiece. I give the credit of my freedom from this to the lower stand pipes, and I do not think that anything less than eight inches should be used.

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MR. WOOD—I do not think that large stand pipes would remedy the difficulty. We commenced running our higher heats, getting present results while having the old 14 inch hydraulic main. The stand pipes started from the mouthpiece at 4 inches, and ended at the hydraulic main at 3 inches. In rebuilding one set of benches we put in a larger main and

6-inch stand pipes, and expected immediate relief ; but we had none We had about the same experience with a 6-inch stand pipe that Mr. Forstall has detailed in his paper. We had fully as much trouble with them as we had with the smaller ones. There is no question but that with high heats you will have stopped stand pipes ; and a superintendent or engineer of a gas works, who boasts of having no stopped stand pipes, can be pretty well assured that he is running low heats.

MR. STARR—We are carbonizing about 1650 pounds per charge ; sometimes it runs down to a little less, but that is the average. We have six retorts, and carbonizd from 275 to 300 pounds per retort, per charge.

MR. HELME—A few years ago I was in Dumfries, where Mr. Malam was running his process, from which great results were expected. He ran his heats as high as he could get them. Dr. Wallace and Mr. Harrison were there examining the process at the time. I noticed that he used water on the inside of his pipe. Right at the top he had a very small trough, less than one-sixteenth and more than one thirty-second of an inch in diameter, along which the water dropped. Immediately under the stand pipe in the mouthpiece there was a 6-inch pipe, which went into the main on the floor. The result was that all of the vapors which were carried down by the water escaped below ; and, although he had such high heats, he had no trouble from stopped pipes.

THE PRESIDENT—Was it a jet of water or a dropping ?

MR. HELME—It was a constant dropping. In Mr. Wood's case the water appears to have lodged on the floor of the mouthpiece, but here there was an escape below the mouthpiece, by means of a 6-inch pipe running into a wide-open trough. There was quite a large amount of water running away from the nine retorts which he used, and he charged from the other end, where there was no stand pipe at all.

MR. WOOD—That is more water than should be used. It does not require so much.

MR. SOMMERVILLE—I was sent, some time ago, to a gas works where they had stopped making gas, and they wanted to

know what was the matter. I found that they had been running very high heats, and had been charging very small charges. The stand pipes were all stopped up. They employed a gang of men, and we found that the hydraulic main was one mass of pitch, and the pipe leading from the main to the condenser, as I afterward found, was also one mass of pitch. In fact, we had to take it out and kindle a large fire and burn it out. I was obliged to get to work as quickly as I could, and I did not take all of the pitch out of the hydraulic main, but only a portion of it. I started the men to charging, and told them to leave in the mouthpiece a shovel of coal, and go ahead. We never had the stand pipes stopped from that time on, and that is the remedy I always apply. A few days ago I had in my works something which is very unusual—a stopped pipe. I told the men to shovel cold coal for a little while on the floor of the mouthpiece. My idea was that this cold coal would cool these vapors. It always has had the effect, in my case, of cleaning the pipes.

MR. FORSTALL—We have tried that plan, and it was almost invariably successful. We put the last shovel of coal in the mouthpiece. But it is a costly remedy, and one that I do not like to adopt. I should like something more scientific. In regard to the Malam process, which Mr. Helme spoke of, in addition to the jet of water in his stand pipe he uses a sort of punch bowl, into which the water drops, and there is a constant evaporation going on in that bowl which most thoroughly and effectively cools the mouthpiece. So that in every case where I can derive relief to the stand pipes from the use of water, it indirectly comes right down to cooling the mouthpiece. But the ascension pipe might just as well, and more profitably, be left hot, because some of the vapors that are condensed in the cooled ascension pipes are those that ought to go into the hydraulic main, and we therefore lose some of our residual products. The object should be to condense in the mouthpiece only such vapors as we cannot carry forward, and let the others pass off without being condensed in the stand pipe. I wish to say, before this discussion is ended, that I do not intend to let the matter rest here. I intend to test it

most thoroughly by methods which I think will be best calculated to arrrive at a correct solution of the problem, and I will report the result at the next annual meeting. [Applause.]

MAJOR DRESSER—I will state that two cases have come within my knowledge during the last two months, where the same trouble existed as has been referred to. In one case it was Mr. Stedman's works, at Newport. They applied Mr. Wood's remedy, and found that it worked satisfactorily. The other case was in Derby, Conn., where the Dieterich furnace had been put in. The furnace did its work perfectly for about two weeks, when, all at once, this stopping of stand pipes took place, so that they were unable to make the quantity of gas they had been making. They applied a similar remedy, dropping water into the pipes, and that relieved them.

MR. ODIORNE—Since this discussion commenced I have learned from the superintendent of the works at Plymouth that his attention was called to this process by Mr. Stedman, of Newport. Previous to that he had been very much troubled by the stoppages in stand pipes and hydraulic main. He had to clean them out every week. He says that he has had no stoppages since he began to use Mr. Wood's process.

MR. WOOD—I do not wish the members of the Association to be misled in relation to this matter. It is not Mr. Wood's process by any means. It was devised by somebody else, and I tried it and found it effective. It was devised by a foreman and put in operation in a small works in Courtland, N. Y., over which I had some supervision. He tried it and found it very effective. He had modified the process somewhat. After he found it effective with small stand pipes he applied for a patent, and in the Patent Office he came across a patent for a somewhat similar process. I think he then changed it somewhat, and instead of making the usual joint in the stand pipe at the mouthpiece, he put some cotton waste in there, and let the water run on that. I have learned within a few days that he succeeded in getting a patent on his process. How it was done, whether by introducing water through the cotton waste or not, I do not know. At any rate, I do not wish it to be

understood that it is my process, because it is not. I simply tried it and found it effective, that is all.

Mr. Odiorne—The stand pipes at Plymouth were 4 inches, and only about 8 or 9 feet long.

Mr. Allen (Poughkeepsie)—You are pleased to say that I am the Methodist class leader of the water gas process, and I suppose that when the class gets into difficulty the leader ought to say something. If I have anything to say I shall be but a few moments about it. I think the difficulty the gentlemen complain of is radical. You have never succeeded in making gas under your present process without these difficulties occurring from day to day. It looks to me as if a merchant might just as well expect his boxes of dry goods to move across the street without any power to move them, as to move that mass of carbon from your retorts without a power to carry it. The trouble is, there is no power, and no permanent support ing gas to carry the amount of carbon in the coal. It must become deposited in your retorts, in your stand pipes and in your hydraulic mains, for want of a permanent supporting gas to carry it. When you come to the point that you make a pure chemical gas in your retorts, and perfect it there, you will have no trouble between that and your holder, and your consumers will have no trouble in burning it. When you can get in your gas a proportion of permanent supporting gas that will carry it off without clogging, you will then give your consumers a high candle power gas that will not smoke. Until you can do that you cannot furnish such a gas. You have been speaking of your troubles. Now, I say that our works at Poughkeepsie run day after day, month after month, year after year, and we send 100,000 feet of gas through 7-inch stand pipes without any sucn thing as clogging, without any ammonia in it, without any sulphuretted hydrogen in it, and without any of these troubles that you complain of. I hold that the reason is simply this—that the gas is not properly formed in the retorts, where it should be formed. After it leaves the retort you cannot make anything else of it except as it was when it left the retort, because the moment it gets to a lower temperature, all the chemical operation of it is wasted, except the condensing

of. that portion of it which has not become volatilized enough to pass off.

The President—Permit me to say that this discussion is upon the question as to how to prevent the stoppage of stand pipes, and not upon the manufacture of gas either from coal or water.

Mr. Allen—That is just what I am now discussing. I say that you want a permanent supporting gas sufficient to take up the carbon as it is volatilized. That is just the point I want to make, and that is the point that I think will be arrived at much more generally than it is now. I say that we can take coal which will yield 20,000 feet to the ton and send in a permanent supporting gas sufficient to take up the whole of the carbon and chemically unite with it, and that will carry it off into your holders without any of the difficulties that you complain of. I say it can be done, and that we have done it. We have made 100,000,000 feet without any of these troubles.

Mr. Cartwright (Philadelphia)—Coal gas?

Mr. Allen—We use naphtha, and we use bituminous coal. It makes no difference what coal you use, nor how much carbon there is in it, if you have a permanent supporting gas ready at hand to take up the carbon as it becomes volatilized. If it is not there at the moment, then it becomes deposited. There is no difference in the gas, whether you make it from oil or coal, because the oil is merely distilled from the coal in the great laboratory of nature. Anthracite coal is the coke of bituminous coal. I will now proceed more to the question as to how to handle that.

Mr. Forstall—Doubtless a man may be cured of the headache by cutting off his head. There is no doubt in the world that if we rebuild our works and go to making water gas we shall cure the stoppage of our ascension pipes. But we are looking for a cheap remedy, and I am afraid that proposed by Mr. Allen is a little too expensive. (Laughter.)

Mr. Allen—Let me answer that. If the gentleman will show me what it costs him to put this gas into his holders, I think I can convince him that we can put gas into his holder,

of a higher candle power, perhaps, than he can make at his works, at a less cost than it now costs him.

GEN. HICKENLOOPER—I call the gentleman to order, and ask that he be good enough to confine himself to the subject under consideration. He is now wandering very far from it.

THE PRESIDENT—It strikes me that you are discussing a subject that it is not proper now to go into, and which does not in any way belong to the matter treated of by Mr. Forstall in his paper. The discussion must be confined to the subject dealt with in that paper, and how to get rid of the trouble he speaks of.

MR. ALLEN—That is just what I was talking about. (Laughter.) It can be done without much trouble, and I was attempting to show how.

THE PRESIDENT—You have stated your position, and Gen. Hickenlooper has called you to order. It is perhaps proper for me to say that I have treated your digression from the subject immediately before us, as I suppose the Association is inclined to regard it; but if the members wish you to go on and defend your system I have no objection in the world, and I will at once put it to a vote.

MR. ALLEN—No, sir; I do not wish to be heard at all.

MR. BURTIS—What I understand we are trying to get at is this: How to keep our stand pipes free in manufacturing gas from bituminous coal, and not from anything else. Those who do not have this difficulty have no need of the remedy. I would like to ask Mr. Forstall if he has noticed at what particular point of time the stoppage in his pipes takes place after the retorts are charged—how soon after the charge is put in?

MR. FORSTALL—It was absolutely impossible to tell, because the stoppages are not constant. They will run over from one charge to another. These pitch stoppages sometimes occur in the middle of the charge, and sometimes at the end. Sometimes the pipes will be stopped at the beginning of the next charge, because the pitch has commenced to form above, and we have to clean our stand pipes between the charges.

The stoppages from dry soot almost invariably occur within the first half hour after the charge is put in. They come very suddenly. I have tried very often to discover some regularity in their appearance, with reference to the periods of distillation, but I have never been able to make a satisfactory investigation on that point.

Mr. Burtis—In some little experience that we have had of that kind, I have noticed that the stoppages would appear to present themselves shortly after the retorts have been charged, but not universally so. We very rarely have stoppages in the bridge or dip pipes, Our stoppages occur mostly in the stand pipes, a short distance above the mouthpiece or on the lid at the mouthpiece ; and sometimes I would have it removed and another lid put on. I never lost the charge, as Mr. Starr has spoken of. I was never troubled to that extent. Some time ago I noticed that condensation took place in the main very rapidly. I adopted a device of my own and used it at every bench having a main of its own, and I had an opportunity of observing the effect. I had an ordinary syphon arranged in such a way that I ran the discharge from the main over into any vessel that I saw fit lying on the floor, so that the sum total of the discharge from the main was run immediately off. I had that remain from the time the last retort was charged until the expiration of the four hours. I made a memorandum of the condensation, and nearly all of it was during the first half hour after the retorts were charged. I have no record of it here, but have at my office, and can tell exactly the quantity of coal that was charged, at what period of time the maximum of condensation took place, and at what period the condensation actually ceased. The impression left upon my mind was that if, in some way, we could get rid of a portion of the condensation after a particular time, we would have less stoppage, because almost all the stoppage that took place was immediately after the charge, just at the time I had determined the bulk of the condensation was taking place, and the ammoniacal liquor and the tar were being formed.

Mr. William Cartwright—I would like to ask Mr. Forstall if he has ever used Higgins' check plate ?

Mr. Forstall—We have used two or three different check plates, Higgins' among them.

Mr. William Cartwright—Mr. Higgins, of Rome, N. Y., has a patent on a check plate, as he calls it. It was brought to my attention some years ago. We have used it occasionally in our works. We are not often troubled with stoppages, our pipes being 7 inches in diameter ; but whenever we are, and it gets to be a continuous thing, we put in these check plates. As long as there is a tendency for the pipes to stop we insert the check plates. Probably by corresponding with Mr. Higgins you can get what information you desire in regard to them.

Mr. Forstall—We have used check plates with some advantage, but I do not think the advantage compensated for the trouble of putting them in and taking them out, because it lengthened the time the retorts were opened, and increased the tar and pitch, so as to necessitate frequent cleaning. We came to the conclusion that the good they did was not sufficient, in our case, to warrant our using them exclusively. They gave us some relief, however. For instance, they would relieve us from a portion of the stoppage in the stand pipes, but would have no effect upon the bridge and dip pipe stoppages.

Mr. Cartwright—We have not had any trouble with our dip pipes whenever we have used the check plates.

Mr. Butterworth—Did you keep any record by which you could tell whether, when you had stopped pipes, you did not have a better yield and make more gas? My idea is that whenever you have stopped pipes you get a better yield.

Mr. Forstall—It was just the reverse with us. We had no stopped pipes in the summer. We very rarely have them at that time. In the summer we always make our largest yield, because, in order to save the men, we run our charges 4½ instead of four hours, and our yield is from 5.20 to 5.50 cubic feet per pound. Very often, on Tuesday nights, after the retorts have been idle all day, we have run up to 5.80 cubic feet to the pound. At such times this summer we have had no stoppages. On the contrary, in winter, when we have been

troubled with naphthaline, we have had to run our heats down a little for the sake of getting rid of the naphthaline. At those very times we have had this trouble with the stoppage of the pipes.

The President—Are we to infer that those who say nothing upon this subject have no trouble from the stopping of their pipes? So far as our works are concerned, we have had very little trouble from this cause. It has never attracted my attention especially. Just before putting in the charge our men often use an instrument such as, I believe, is used by Mr. Forstall, to clean out the accumulated material. We have no trouble, however, so long as we use the regular coal. We did have some trouble when we used other kind of coal, to which I have referred.

Mr. Sommerville—Have you arrived at the conclusion that the trouble is the fault of the gases that come up the pipes?

Mr. Forstall—Not the gases, but the vapors. I am satisfied that the gas, after it leaves the retort, loses its heat very rapidly. The heat is retained by the vapors that form the tar and pitch. I think that these have a very high heat, and if we could arrest and cool them, we would not have the heat which goes to form the pitch, and would entirely prevent the stoppages in every case. What I am looking for is not a partial remedy which will relieve the stand, bridge and dip pipes when they are stopped, but for something which will entirely and inevitably prevent the stoppage in any part of the apparatus. And from experience and thinking the matter over I do not think we can accomplish this unless we can stop these particular vapors which do the mischief, and take them out at that point where we can easily intercept them. I have no doubt whatever that the cooling of the ascension pipe by Mr. Wood, as I have said, affords relief by that very action. My difference with Mr. Wood is merely a difference of detail. It is not a difference of principle, He accomplishes in his ascension pipes what I want to accomplish in the mouthpiece. I would like to save a little more tar. I have no doubt that the cooling of the ascension pipe along its whole length will cause

a greater condensation of tar, which must inevitably find its way to the mouthpiece, and thus we have a loss of our residual product.

The President—That raises the question of how much tar you save and how much tar Mr. Wood saves.

Mr. Coggshall—I have observed in my experience that when we were using iron retorts, producing only three and a half feet, we had stopped dip pipes. We reach now from five to five and a half, and I very seldom have stopped stand pipes. I use, of course, larger pipes than I had at that time. I have not, for years and years, had a stoppage of a bridge or dip pipe. I have stoppages, however, at the mouth of the retort. I have a half-inch hole in every lid, and I have a crooked rod, so that if we see there is any stoppage, we can run the rod in without taking the lid off the mouthpiece, and thus relieve at once the opening of the stand pipe. We lose no gas to speak of, for it is all done in a moment. That answers every purpose. I stop up the hole with mortar.

Mr. Fuller—I have had some experience with stoppages. I have had some correspondence with a party in regard to the remedy. I think the same party used, as we do, a crook made of a flat piece of iron a great deal smaller than the pipe (our's are 6-inch pipes), twisted half way round, something in the shape of a rainbow. We attached this crook to the end of a rod, so that we can run it up to the first joint. We had, some time ago, one that was an eighth of an inch, and with this crook attached we could run it to clear the stopper. Before we would draw our charge, or after the charge was drawn, we would insert both crooks. We have never had any trouble since, and have never had a stoppage. It is all done in a moment.

The President—We are now prepared to hear General Hickenlooper's paper.

Mr. Wood—Before General Hickenlooper commences, I would move that a vote of thanks be tendered Mr. Forstall for the very interesting paper he has submitted. (Carried.)

General Hickenlooper then read a paper entitled

STEAM STOKING INVENTIONS AND THE RELATIONS THEY BEAR TO GAS INTERESTS.

In presenting a brief outline of the important subject embraced in the above title, it is not particularly flattering to the vanity of the controllers of the vast interests so unreservedly confided to our care, for me to assert without fear of contradiction, that no manufacturing industry of equal magnitude, inaugurated during the present century, has derived less aid from mechanical appliances than that of the manufacture of gas.

While we are frequently disposed to congratulate ourselves upon the wonderful growth of the industry we represent, may we not well stop to consider how much of that growth can properly be attributed to the uncultivated demand for an article of prime necessity, and how much to intelligent and successful efforts made to improve the quality and decrease the expense of its production.

With the single exception of the exhauster, no important advance has been made by the utilization of steam power since the days of Clegg, for in all other essential features gas is to-day, made and distributed as it was over a century ago.

Why has such a condition of affairs existed? Certainly not because there has been no demand for such assistance, or desire for improvement, for I doubt if there is a single member of the profession who will not admit, or does not fully appreciate, the advantages to be derived from the adoption of any new and improved system of retort house labor, which would result not only in reducing the cost of manufacture, but in rendering us less dependent upon the expensive, peculiar, and exacting class of labor upon which we are now compelled to rely for continuous and unceasing production.

Can it be that it is because, in fancied security from competition, we have sat ourselves down to enjoy the present at the expense of our future, or have we too zealously guarded the sacred precincts of our retort houses, or made of our business too select or secret an industry, whereby mechanical experts

and inventive geniuses have been deprived of an opportunity of studying our system and supplying our wants? Or is it because, as a general rule, the controlling officers of our companies are unfamiliar with the details of manufacture, and the works managed by practical but unscientific men, so engrossed by the cares and responsibilities of their positions, that they have neither time nor desire for great mental exertion or co-operative action?

If this be true as a rule, there are certainly notable exceptions, for some of the brightest intellects and most highly educated and accomplished engineers of the country are to-day identified with gas interests; and even where such men as these have failed, success has not unfrequently been achieved by men possessing less culture but greater natural talents, who, contending against difficulties innumerable, have fought their way up, step by step, from the very humblest walks of life to the highest pinnacles of fame.

I can therefore see no valid reason why we should be so far behind in the race of improvement, or why this power, if properly and scientifically applied, should not, in the near future, perform as great wonders for the gas producer as it has already accomplished for other industrial pursuits, when it converted the low hum of the spinning wheel into the music of a thousand spindles, or substituted the lightning-like flash of the locomotive for the lazy laboring of a rumbling coach.

To whatever cause past indifference or present delinquencies may be attributed, certain it is that hereafter we may expect to be called upon for the more general exercise of a higher degree of intelligence and nerve, the adoption of a newer and more scientific principles of manufacture, and a broader comprehension of the necessities for keeping pace with the advances made in other departments of mechanical industry, through the substitution of steam power for the present slow and laborious work of the human stoker; for it is indeed humiliating to realize, that during an age celebrated for the wonderful achievements accomplished by the substitution of machinery for manual labor, the prevailing system of charging and discharging retorts should remain as it was before any of

the gentlemen here assembled made their debut upon the retort house stage, and this, notwithstanding the numerous, but I fear feeble efforts which have been made to accomplish so apparently simple a task.

Maiben, of Perth, was the first to take a progressive step as early as 1814, by inventing his "horizontal rotary retorts," which were placed in successful operation at the Royal Mint, Birmingham, Chester and Bristol.

Mr. Clegg afterwards constructed one based on nearly similar principles, but of greatly increased capacity, for which he obtained Letters' patent in 1816, and soon thereafter followed with his "Webb retort," capable of extracting 11,000 cubic feet of gas from one ton of coal.

Mr. Brunton followed in 1835 with his invention for feeding retorts from a hopper, the coal being pushed forward into the retort by a piston working through a stuffing box, forcing the coke back into a water-sealed chamber at the opposite end.

Grafton followed, three years later, with his novel and ingenious invention of a scoop with closed end and sliding bottom, which, while being inserted, forced the coke at the opposite end of a through retort, and as drawn back deposited the coal of a fresh charge.

Geo. Michael then followed with his patent for a steam stoker, to be operated in connection with huge brick through retorts, $30'' \times 9 \times 2$ feet into which the coal was charged through openings in the arch above, and from which coke was pushed out by a ram beam with cast iron head, the whole operated by suitable machinery. This, I may say in passing, is almost identical with the machines now being used at Pittsburg for discharging coke ovens.

From this on, for a period of 20 years, little or no effort appears to have been made in this important direction, until 1860, H. Green, of the Bolton Works, constructed a machine to which power was communicated through the agency of a square shaft operated by a stationary engine located at one end of the retort house, and upon which shaft were affixed movable spur wheels, connectable with the machinery, and thus operating an adjustable rake, and a scoop to be filled by hand but inserted, turned and withdrawn by machinery.

Wm. Malam, during the following year, invented a charging scoop which upon being moved rapidly forward with a shovel-like motion, and then suddenly stopped, projected the coal into the retort.

It was not, however, until 1865 that any real practical advance was made toward the accomplishment of stoking by machinery, in which year Messrs. Best & Holden invented a machine operated by steam. It consisted of a frame supporting a coal hopper, boiler, engine and machinery for operating the three rakes and scoops, which latter being in a fixed position, necessitated a special arrangement of the retorts, and the charging and discharging of three at one time.

This objectionable feature was afterward overcome by Holden, to whom a patent was issued for an arrangement by which either of the rakes or scoops could be swung out at right angles, so that one or more could be operated at pleasure.

Geo. Simpson next followed in 1867 with a patent charger, which provided for metal trays filled with coal, to be deposited in ordinary retorts until carbonized, when they were to be withdrawn, discharged and refilled by suitable mechanical appliances.

The following year witnessed the introduction of Dunbar & Nicholson's machine, consisting of a combined scoop and rake, the latter working inside of the former, the whole moving upon an over-head trackway and operated by an endless wire rope or chain.

W. T. Carpenter, in 1869, and also in 1876, obtained patents for mechanical appliances which, in all essential features, appear to be but a repetition of those of Brunton, for which patents wese granted in 1835.

Wm. R. Lake, of London, but a few months later, patented a scoop with a reversible web or apron bottom, operated by suitable machinery, communicating longitudinal and lateral motion. The general features of this apparatus bear a striking resemblance to those of the Grafton patent in 1838.

H. A. Bonneville, in August, 1869, received a patent for a machine, the principal feature of which was the formation of a scoop in two sections, which, upon being inserted in a retort, opened and deposited the coal below.

J. R. McFarlane, of Manchester, two years later, patented a combined rake and scoop, on the extreme end of which was an iron plate, so hinged as to preserve a horizontal position while entering, but when acted upon by a lever, descended and raked out the coke while being withdrawn. It also had a hinged bottom, through which the coal passed from the scoop to the retort.

In the latter part of 1871, Messrs. Somerville & Robinson, of the Dublin works—where the Best and Holden machines had been previously operated—received a patent for a steam stoker, the special feature of which consisted of a reversible scoop filled from a sliding chute as it entered the retort. Mr. Robinson, some years later, improved upon this by substituting a divisible scoop in two segments, one of which folded over the other. The rake consisted of a U-shaped bar, in the hollow of which rested a light rod, by which the rake head was lowered or elevated. The whole operated by suitable steam machinery.

Messrs. Porter & Lane then entered the field with a novel apparatus for the production of gas through the agency of a vertical retort, to which prepared coal was automatically fed, and passed through in close contact with the sides of the retort by a permanent feed screw operated by steam, the coke falling into a coke box below, from which it was quickly removed by opening a self-sealing lid.

This was followed by the "Rowland Steam Stoker," which, although somewhat complicated, well represents the wonderful mechanical skill and Yankee ingenuity of its talented inventor.

Wm. Mann, of London, next entered the field, in December, 1872, with his separate steam charger and discharger. The coal being carried by a bucket belt to a receptacle from which it could be discharged into a scoop, divided into two parts longitudinally. When this scoop has entered the retort a suitable distance, it is sprung open and the charge thus deposited.

The rake-tube has a head with axial motion operated by a chain or rod within the tube, and at outer end has affixed a small scoop or shovel with which to loosen and remove the tar cake.

Wm. Foulis, of Glasgow, in January, 1873, received a patent for his "Hydraulic Stoker," the power being communicated to cylinders or tubes, which, under hydraulic pressure, opened and closed telescopically. In the original design the coal was brought into the retort house in boxes the length and width of the scoop, and by a simple mechanical contrivance each box was raised from its truck, brought over the scoop, the bottom sprung open and the charge deposited; hydraulic pressure then being applied, sends the scoop forward into the retort, inverts and withdraws it.

The discharge is effected by bringing the telescopic rake tube to the desired position and applying the pressure at alternate ends. The inventor, during the same and subsequent years, obtained patents for improvements, under which he operated the scoops by a chain or band connections passing over forward and rear drums; he also made the scoop attachable to the machine by means of a T-head catch fitting into a corresponding opening, by which arrangement he avoided the necessity for using supplemental scoops or trays, as, being removable, they could be filled at one side and then swung into position ready for use. Slight improvements in the rake were also made, by which some of its functions were automatically performed.

A few months later Messrs. Taylor, Buckley and Chadwick, of Oldham, patented a machine consisting of a scoop or box, with sliding bottom and rake attachments. When used, this combined scoop and rake was thrust forward into the retort, the rake heads turned down, and as drawn back it brings out the coke and deposits the coal.

Mr. Maquay, of Dublin, in February, 1873, patented a novel device for charging with coal contained in metal cylinders, at one end of a through retort, and discharging by means of a fixed rake, working through a stuffing box, at the opposite end, by which the coke was to be drawn into a closed well below.

W. Richards, during the same month, patented devices for drawing and charging, the latter being accomplished through the agency of a reversible scoop, and the former by the application of the motion generally known as the "lazy tongs." All mounted on suitable carriage and operated by steam.

[illegible]

[illegible] was communicated by [illegible] length of the [illegible] by rotating [illegible]

[illegible] a patent for a stoker [illegible] which, when propelled [illegible] coke out at the

opposite end, and on the return stroke deposited the coal by moving the outer casing of the scoop back, outside of a stationary plunger, thus forcing the coal out of the end of the scoop while being withdrawn.

J. Steele, of Glasgow, in August, 1875, received provisional protection for a device by which coke could be discharged from a retort through the agency of a steam or compressed air blast.

A. M. Clark, of London, during the following year, received a patent for placing coal in metal cylinders or cases, or to be inserted in ordinary retorts; and also for a scoop, with a plug or plunger held in position by a stiff spring, which on being released, forced the coal out of the scoop as it was being withdrawn from the retort.

J. Warner, of South Shields, next followed, in 1877, with a patent for a stoker, the general feature of which are two vertical cylinders or hollow rams; on each of which is mounted a cradle for carrying the reversible scoop and rake; the whole forms a quadrilateral frame 10 feet by 3 feet, mounted on wheels and operated by an endless wire rope. The scoop and rake cradle is free to turn on the rams, and may therefore be worked at any angle. It is necessary to the introduction of this apparatus that material alterations be made in any existing plant, and the form of settings be adjusted to the requirements of the machine.

Quite recently MM. Servier, Monnier and Rouget, of Paris, have introduced to public notice a hand charging machine, consisting of a hopper of sufficient capacity to hold six charges, opening at the bottom into a barrel distributer or coal valve, regulating the discharge into twin sheet iron scoops, about 4 feet in length, located upon a small, cast iron car, to be driven into the retort by windlass and chain connection. The scoops are required to enter twice, and are turned by the movement of square shaft trunnion and pinion, located between the scoops. It appears to be practically but a less efficient combination of principles before adopted by Rowland and West.

upon two longitudinal and five transverse wrought iron 6-inch I beams; the former 8 feet in length, two of the latter 13 feet 3 inches, and three 8 feet three inches in length, all united by angle plates and rivets, forming a light and durable frame, carried upon four 24-inch flanged wheels, 4-inch face, and keyed to 2½-inch axles 9 feet 2½ inches long, with bearing journals 2 × 6 inches, moving upon an eight-foot gauge permanent trackway laid upon the retort house floor, parallel to face of benches. On one side of this platform are located the boiler, with independent feeder, pop safety-valve, steam-gauge, etc., water tank and light direct reversing propelling engine. The boiler is 7 feet in height by 38 inches in diameter, with inside fire-box, and ten 6-inch rivetted flues.

Located transversely across the other side is a rectangular frame, the horizontal braces of which are the guides for the reciprocating traveler. This frame consists of two vertical cast iron columns bolted to the ends of the transverse platform beams, and having three wrought iron pipe struts secured by 1-inch tie rods passing through their centers.

The column nearest the bench is provided with guides for the reception and vertical play of a sliding box, which the operator can raise or lower at will, and upon which are affixed grooved rollers and flat-faced wheels turning on studs to sustain and guide the rake bars, any one of which can be clamped to the traveler or to the rear column when out of use. The traveler is a hollow cast iron cross-head, riding between the guides upon duplicate grooved friction rollers above and below.

The rakes are operated by means of a horizontal steam cylinder of 36-inch stroke, located parallel to, and on the right of the guides of the traveler; the piston rod is attached to a cross head moving in guides and carrying a toothed rack, which gears with a gum metal pinion shrouded at either end, and thus giving an alternating rotary movement to the pinion-shaft journaled beneath the platform, upon which is keyed a drum carrying a chain, thence around grooved idler-rollers, turning upon studs secured at the sides of the front and rear columns respectively, and secured, upon opposite sides, to the

traveler. By this means the reciprocation of the piston produces a corresponding movement of the traveler carrying the rake bars, and by suitably adjusted hand valve gearing the length and direction of the stroke can be varied by the operator at will. The speed of the traveler is governed by a water cylinder located on a prolongation of the line of the steam cylinder and connected therewith by a solid piston. A pipe connects the opposite ends of this water chamber through which the water displaced from one end is forced back into the other; the permitted rapidity of displacement being by the full way cock placed thereon.

A special means of cushioning the impact at the end of the stroke is provided for by locating an air chamber beyond the displacement port, into which the water is forced; this chamber is provided with an automatically acting air valve, which closes upward as soon as the water commences to rise in the chamber, and opens as soon as the pressure of air in the chamber equals that of the atmosphere.

These governing devices are supplemented by rubber buffer-springs on the traveler.

The rake beams are of rolled angle iron 4½ inches by 1½ inches by 11-16 inch tapering from rear to front.

The rake heads are steel castings of any shape suited to the size of the retort, hinged to the ends of the rake beams by rule joints which permits them to turn freely under the beams, should they meet with any obstruction while being projected forward over the coke in the retort, and to assume a vertical position when brought into contact with the charge during the outward movement.

The whole machine weighs about 7,000 pounds, and can be at once introduced into any existing retort house having not less than 16 feet of space between mouthpieces and side wall, without any change or preparation other than laying the track upon which it is to be moved.

The *Charging Machine* consists of a rectangular carriage 10 feet in length by 9 feet in width, the framing of which consists of two longitudinal and four transverse 6-inch I beams, united by angle plates and rivets, and mounted on two pairs

of track wheels 12 and 24 inches in diameter, keyed to 2½-inch axles.

Upon one side of the platform covering this framing are located the boiler, steam reservoir, water tank and propelling engine. On the other portion is mounted the supplemental carriage carrying the coal hopper, together with the devices for elevating and controlling it.

The steam boiler and attachments, as also the propelling engine, are duplicates of the ones upon the discharging machine.

The steam reservoir is a vertical cylinder six feet high by 2½ feet in diameter, the space between it and the boiler being occupied by the water tank.

The supplemental carriage consists of two triangular supporting frames of wrought iron pipe, rising about 10 feet above a square base, mounted upon track wheels arranged to run upon rails laid upon the main platform, and upon which it is moved to and fro, by hand windlass and chain connection. Across the top of this frame is journaled a horizontal shaft, which also forms the top brace of the supplemental carriage; the side braces also forms guides for the hopper, which, being loosely adjusted, admits of a free vibration. The "hopper" is suspended between the two side frames by chains winding upon sheaves keyed to the shaft above, upon the projecting ends of which shaft are secured, at one end a brake-wheel, and at the other a sheave, having thereon a winding chain attached at its free end to the piston rod of an upright cylinder, secured upon the platform of the supplemental carriage and against the vertical brace of the adjacent triangular frame.

This cylinder is single acting, and as its chain winds in the opposite direction from those supporting the hopper, it operates directly against the weight of the hopper and its contents. Steam is supplied to this cylinder through a swivel-jointed pipe, which, having a three way cock, answers also for an exhaust. This elevating mechanism and attached brake wheel enables the operator to instantly adjust the coal hopper to any desired height.

The "hopper" is a funnel-shaped, sheet-iron vessel, divided

by vertical partitions into three compartments, each containing sufficient coal for one charge. These partition plates are so hinged at their upper edges that the coal contained in each compartment can be alternately discharged into the conduit below.

In the rear of this conduit is located a pipe with a series of jets nozzles, horizontally disposed, so as to discharge against the coal and thus project it into the retort.

The connection is made between the conduit and the dry steam reservoir, by a swivel-jointed copper pipe, which accommodates itself to the movement of the supplemental carriage.

The discharge is effected by opening a "Wilson" or other quick opening valve, located near the steam reservoir, which, with the lever of the propelling engine, the three way cock of the hoisting cylinder, and the brake lever, are all located within convenient reach of the operator.

It will thus be seen that the fundamental principle of this system of charging, is a dry steam or compressed air blast, used explosively, in direct contact with the charge of coal, without the intervention of any mechanical appliances ; the mechanism otherwise employed is of the most simple and durable character, enabling a single operator, by the exercise of ordinary skill, and with but trifling personal exertion, to control every movement necessary to the successful operation of each machine.

In the practical operation of these machines, at the works of the Cincinnati Gas Light and Coke Company, an attendant strikes the lids from three retorts, or one-half of a bench, the discharging machine is then brought into position opposite the upper retort, with the corresponding rake pinned to the traveler, when the operator, with his right hand on the lever used for controlling the vertical play of the rakes, and his left upon the valve lever of the steam cylinder actuating the traveler, elevates the guide bar to admit the rake-head into the retort above the charge ; and as the rake is projected forward, should it meet with any obstruction, it folds back under the rake-beam, and again assumes a vertical position when the obstruction is passed or the withdrawal begins. His position is at

such a distance from the mouthpiece that it gives him every opportunity for observation unembarrassed by the heat or smoke arising from the expelled coke, and the thrust being governed by the automatic devices before referred to, his entire attention can be centered upon the direction of the movement and the vertical adjustment, perfectly governed by the two levers under his immediate control, enabling him to arrest, renew or reverse the movement, or to elevate or depress the rake-head at any desired point. The tar cake is first removed by a short stroke, followed by such other movements—usually from four to six—as may be found necessary to clear the retort; the whole occupying not exceeding fifteen seconds.

This rake-beam is then detached from the traveler and pinned to the column, the next lower one shifted into position and the discharging operation repeated.

The discharging machine is closely followed by the charger," which, having, been coaled by chutes leading from the bins, conveniently located along the side of the retort house, is moved into position opposite to, and in a vertical line with, the lower or first retort to be charged.

The operator then runs forward the supplemental carriage by its hand propelling windlass until the guide flange of the conduit enters the mouthpiece, and effects a discharge by three or four quick openings of the Wilson valve, so graduated that the first blast will project a portion of the charge to the rear of the retort, the succeeding blasts depositing their charge uniformly in front of it. The skill necessary to do this perfectly can be acquired by any intelligent workman in a few hours.

The hopper is then moved back a few inches and the main carriage run to one side far enough to allow the lid to be closed by an attendant in the usual manner. While this is being done, the hopper is being elevated to the level of the next retort, where it is held by the brake before referred to, the partition plate sprung open, admitting coal to the conduit from one of the other compartments, the machine moved into position in front of the next retort, the secondary carriage moved forward, the valve opened, and the retort charged as

before, which operation occupies about six seconds from the adjustment of the conduit to the mouth of the retort, until the whole charge is deposited.

After three retorts have been thus charged, the "hopper" is lowered, drawn back upon the supplemental carriage to its limit of travel, the machine propelled to the nearest coal chute, and the hopper filled as before.

This process is repeated as often as desired, or to the limit of the working capacity of the machine, which, including re-coaling, etc., will, with one operator and one assistant to each machine, average over sixty retorts per hour. Out of this a certain amount of time must necessarily be allowed for rest of operator, replenishing fire, watering, oiling, etc.

At our works a pair of machines have, with apparent ease, drawn and charged twenty-seven benches, or one hundred and sixty-two retorts, which, with four-hour charges, gives forty minutes work and twenty minutes rest.

The guaranteed capacity of these machines—one retort per minute—appears to make it unnecessary for me to enter into any very accurate detailed estimate of the saving due to the introduction of such a system, for this must, to a great extent, depend upon the cost of retort house labor in any works with which it is desired to institute a comparison.

I will, however, submit a few facts and figures, based upon our own experience, in order that you may at least be able to form an approximate estimate of the pecuniary advantages attending their introduction.

In fairly considering this subject, it must not be forgotten that many of the changes which it appears advisable to make, in order that the best possible results may be obtained, carry with them their own attendant advantages, and should not, therefore, be taken into consideration unless placed to the credit of machine labor. Take, for example, the handling of the coal, which, by the aid of suitable mechanical appliances, can be prepared, elevated, stored in bins, and run into the hopper of the machine, at much less expense than is now required to place it on the retort house floor by manual labor, and if, as should always be the case, this storage capacity is in

excess of the daily demand, night work, always the most expensive, can be entirely dispensed with, and a constant supply of dry coal be kept conveniently near.

The discharged coke can be disposed of in exactly the same manner as if drawn by hand, which makes it unnecessary to introduce the cost of delivering coal and removing coke in any statement of comparative cost.

No very accurate estimate can, as yet, be made of the depreciation and cost of repairs, but certain it is that the latter will be much less than the sum now expended in repairing and renewing retort house tools, and will not, therefore, be included in the estimate.

The maximum working capacity of one pair of these machines can be fairly fixed at 30 benches, or 180 retorts which gives 45 minutes work and 15 minutes rest, and the operation of which will be covered by the following estimated expense:

Interest on investment, say $10.000 at 6 per cent.	$600.00
Depreciation, say $10,000 at 10 per cent	1,000.00
4 Engineers (2 d. and 2 n.), 365 days, at $2.50.	3,650.00
2 Assistants (1 d. and 1 n.), 365 days, at $1.75.	1,277.50
4 Lid-men (2 d. and 2 n.), 365 days, at $1.50	2,190.00
10 Firemen (5 d. and 5 n.), 365 days, at $2.00.	7,300.00
Fuel—coke, 30,000 bushels, at 4 cts..........	1,200.00
Water—city, 700,000 gallons, at 10 cts........	70.00
Oils, cylinder, 62 gallons, at 80 cts	49.60
Oils, lubricating, 62 gallons, at 25 cts	15.50
Oils, illuminating, 40 gallons, at 20 cts........	8.00
Packing, 30 pounds, at $1	30.00
Cotton waste, 100 pounds, at 10 cts...........	10.00
Men, 20; cost	$17,400.60

Producing 20,491,830 cubic feet per man, at an expense of 4½ cents per 1,000.

To perform this same service under the present system of retort house labor (four men to five benches), requires the services of 48 men (24 day and 24 night), for 365 days, at $2.50 = $43,800; producing 8,538,242 cubic feet per man, at an expense of 10.68 cents per 1,000 cubic feet, showing a saving of

$26,600 per annum on one pair of machines, or 6.43 cents per 1,000 cubic feet manufactured.

While this saving will be proportionately greater in large, and less in small works, their use can be made profitable enough to warrant immediate introduction in any works having in action over six benches in one range.

In considering the adaptability of such a system, it must not be expected that these machines, unlike any others, can be kept in constant and continuous operation, day and night, for years at a time, without being temporarily thrown out of action for cleaning and repairs.

The controllers have therefore wisely decided to furnish with each order one pair of reserve machines at exact cost of construction, leaving the charge for "working machines" to be fixed according to the following schedule:

One pair, twelve thousand dollars	$12,000
Two pairs, twenty-two thousand dollars.......	22,000
Three pairs, thirty thousand dollars............	30,000
Four pairs, thirty-six thousand dollars..........	36,000

which is believed to be only about six months' saving, due to working them up to their maximum capacity.

I am perfectly aware that the consideration of this important subject is in no sense new to the members of our profession, and that they, no less than myself, appreciate the advantages due to its successful accomplishment.

But I do fear that the gravity of the situation, and the necessities of the hour have not sufficiently impressed themselves upon the minds of our people.

The vast and constantly increasing use of illuminating oils, the pressure of water gas theorists, and the prospective possibilities of the electric light, all conspire to admonish us that the time for prompt and decisive action has arrived; that we should no longer await the result of future possibilities, or the action of our neighbors, in order that we may profit by their experience. It must not be expected that our interests will prove any exception to that inexorable law—the survival of the fittest—or that profits such as we have enjoyed in the past are o be hoped for in the future by those who are satisfied to sit

still while the balance of the world is moving on. Each should put his shoulder to the wheel, and together aid in progressive movements all along the line.

It will not hereafter be accepted as a sufficient excuse that such a course will involve expenditures not warranted by present profits, or that existing works are not designed to suit the new order of things—they must be made to do so, and without delay, in order that we may, to some extent, make amends for the errors of the past, and avert the penalty of thoughtless improvidence, *gradual decay*.

Applause followed the reading of the paper.

THE PRESIDENT—This matter is now open for discussion. I presume Gen. Hickenlooper will be very happy to answer any questions that may be propounded. It may be, however, that members may prefer to wait until morning before entering into a discussion of this paper, as it is now a little past five o'clock.

MR. HELME—I think it may be a good subject to start with in the morning. It is now a little too late to go into the matter thoroughly.

MR. FORSTALL—I think we should conclude the subject to-night. It is now only a little after five o'clock, and the paper is fresh in the minds of the members. To-morrow morning they will probably have forgotten some details and some questions they may now wish to ask. I am sure Gen. Hickenlooper prefers to have it discussed to-night.

THE PRESIDENT—I hope the discussion will proceed briskly, and that the members will not wait upon each other.

MR. FORSTALL—I have no questions to ask. I simply wish to say that I have studied the subject of the steam stoker, and our manager has done the same. The result of our examination has been that we have ordered four machines.

THE PRESIDENT—That is very valuable testimony.

MR. HELME—The very first time I saw it it impressed me very favorably. I thought it was with that, as with every new machine, that some little improvement could be suggested. The only real difficulty I see in it is that it costs a little too

much for small companies to take hold of. I think Gen. Hickenlooper spoke about six benches. That would be about thirty retorts. I do not doubt that it could be used to advantage in that case, because one or two of the men that the General spoke of could probably be dispensed with, for the reason that you would not want to charge as rapidly as you would with a larger number of retorts. There are, however, a great number of works running less than thirty retorts, and such works might find it expensive. I saw a mechanical stoker that Mr. Somerville had in Dublin some years ago that was very much more costly than this. I have also seen two others.

MAJOR DRESSER—With reference to the time that is employed in the use of these machines, I will say that I was in Cincinnati last spring, and spent several days in investigating this subject. I went into the retort house at odd times, without any one knowing that I was coming, to time the operation. I saw several times eighteen retorts drawn and charged in sixteen minutes. That seemed to be about the rate at which they were working right along, and they only had two men on the machines, and the men opening and shutting the lids as referred to by General Hickenlooper in his paper.

THE PRESIDENT—Did that include the time taken to fill the hoppers?

MAJOR DRESSER—Yes, sir; because the time occupied by the drawing machine is longer than that occupied by the charging machine. The charging machine can work faster than the discharging machine; consequently they utilize the time they are waiting for the retorts to be drawn in filling their hoppers and getting ready to go on. The whole thing is regulated by the rapidity with which the retorts can be drawn. When you time the drawing machine you time the whole operation. It is a question for any large works whether there could not be some arrangement made by which it would not be necessary to use one charging machine with each drawing machine—whether one charging machine could not charge the retorts for two drawing machines, if it could be made to work satisfactorily. The time for charging a retort averaged

six seconds, as the General has stated. The time for drawing varied somewhat, according to the character of the charge.

There was another thing that struck me very particularly in regard to the matter, and that was the uniformity with which the coal was distributed on the bottom of the retort by the charging machine. Mr. Edge used to say that if he could have a retort charged exactly as he wanted it, he would have about three and a half to four inches all over the bottom of the retort. The work of this machine comes as near to that standard as anything I have ever seen. There was no piling up of the coal; it was laid with great evenness and exactness. The first coal was sent to the rear of the retort, the next one just in front of it, and the next just in front of that. When the lids were open to discharge the coke, you could see exactly the condition in which the coal was left by the charging machine. In going through eighteen or twenty retorts, you will see no variation. The whole thing is done without any trouble. I was told that one of the men who was operating one of these machines, which discharged 18 retorts in 16 minutes, had never been on the machine before that morning. The regular man was sick or away, and they took a man out of the works to fill his place. He was an American, and, of course, not a blundering man; but, at the same time, he was not a man of more than ordinary intelligence. I think that here is a field wherein very many gas companies can save a vast amount of money, and not only that, but an immense amount of wear and tear upon the human system, which now takes place in the work as done by stokers. The men are removed so far from the fire that it is not disagreeable work to run the machines.

The President—And its use, in a great degree, creates independence of strikers.

Major Dresser—Of course. If you did not use the machine—if you simply had it in the corner of your retort house, ready for use in the time of a strike, it would be worth the cost of a machine. Where you have large gangs of men to deal with this is an important item.

Mr. Page—It was my privilege, ten years ago, to be in the Dublin retort house shortly after the Somerville stoker was put in operation. Although that was heavy and cumbersome, it was a great step in the direction of substituting machinery for the manual labor of stoking, which, of all work, is unquestionably the most terrible in its effects upon the human system. When I saw those scoops run into the retorts and the coke withdrawn. I could not but take off my hat and give three hearty Yankee cheers for the steam stoker. But you all know the result of the Somerville stoker. The heat soon warped those long iron scoops, and I believe that before I came back to America the Somerville stoker was laid up for repairs, and I do not think it has been in operation since. But the one that I have had the privilege of seeing in operation twice at Cincinnati seems to me to embody, especially in the manner of charging, that feature of American invention that we find in the Howe sewing machine and the McCormick reaper. I can testify to what Major Dresser has said in reference to the time occupied in putting the coal in, and to what has been stated by General Hickenlooper on the subject in his paper. The coal is projected on the bottom of the retort just like this—"chip, chip, chip." As quickly as that the coal is in the retort. I am sure we must all agree, from the facts that have been presented here, that mechanical stoking is one of the greatest advances yet made in behalf of gas interests. Unquestionably, by-and-by there will be a change made in the mode of removing coke from the retort. Instead of doing it mechanically with a rake, I believe that some inventive genius will put steam in behind and shove the coke out.

Mr. Burtis—I have nothing to say about the merits of the machine, for I have never seen one. Last year I was in Cincinnati, and went to see it, but they were putting in a larger boiler, and the machine was not in operation. I have not had the pleasure of being in Cincinnati since that time, and have not seen the machine at work. A little over two years ago, when I was abroad, the Foulis machine was in operation both in Glasgow and Manchester. Having occasion to call upon the engineer of the works at Manchester, I made some inquiry

in reference to the working of the machine. He took out his watch, looked at it, and said: "They have just commenced to draw a range of sixty retorts; the time is so and so. We will go around elsewhere, and come back presently and see how long a time it has taken them." He had not been in the retort house, and the men did not know they were being timed, so far as I know. We went around through the purifying house and elsewhere, and came back just after they were through charging. They had discharged and recharged the sixty retorts in just about an even hour. I saw nothing there at that time in reference to the warping of the scoops that Mr. Page alludes to. They were working there more effectively, I believe, than they were in Mr. Foulis' works. Everything went along very smoothly. The coal was brought into the retort house in a different manner from that employed in Cincinnati. They have ponies, fine little animals, that seem to know their business as well as many men. They are attached to a little carriage that receives about three of these scoops. They come alongside of an iron crane which is attached to the scoops, the crane is swung around and the thing is put in its place. The time occupied in discharging and charging the retorts was very small, yet I am well convinced, from the statements that have been made here, that the Ross machine will do the work quicker than the Foulis machine.

The point that you made, Mr. President, about being independent of strikes, is one of the very things we should look to in mechanical appliances, not only in the Ross stoker, but in any other machine that will do the work as we wish it done. We know from experience that men are very apt to take advantage of our necessities, when we are, perhaps, in a dilemma, to demand that which is unreasonable. Now, if we have a machine to discharge the coke and charge the coal, then, when we have made our peace with the three or four men who manage them, we can put in ordinary men, with not much brains but a good deal of muscle, to break the coal and prepare it. We shall then, indeed, be independent of strikers, which is certainly a most desirable position to be in.

MAJOR DRESSER—There is another point in regard to the

character of the labor employed on these machines. It is of an entirely different character from the ordinary stoking labor. It is more of the character of men who run stationary engines, or run upon steamboats, men who can be easily replaced, particularly in the small numbers which are required. In considering the matter of strikes, that is an important item. You can easily replace these men, so few in number, while it may be difficult to replace men who are sufficiently skilled to act as stokers, and where, in stoking by hand, a much larger number would be required.

THE PRESIDENT—As it is now near the hour of adjournment, perhaps it would be better to let this subject lie over until to-morrow. It can be taken up at any time after we meet.

There is a matter that ought to be attended to at once, and that is the appointment of a committee to recommend a place for the next annual meeting. I appoint as that committee, Messrs. George B. Neal, Samuel Prichitt, and John H. McElroy, to report sometime to-morrow.

Upon motion made and seconded the thanks of the Association were tendered to General Hickenlooper for his very interesting and valuable paper.

On motion of Captain WHITE, the Association then adjourned until the following morning at 9 o'clock.

SECOND DAY—OCTOBER 14TH.

The Association met at 9 A. M., pursuant to adjournment, and was called to order by the President.

THE PRESIDENT—The first business in order is the report of the committee in regard to the place of the next annual meeting.

MR. NEAL—The committee are not yet prepared to report. They will, however, submit a report before the close of the meeting, and in ample time to give the Association an opportunity to act upon the question.

THE PRESIDENT—I think it would be well for the committee to report at 2 o'clock this afternoon.

THE SECRETARY—There was a recommendation of the Executive Committee yesterday, which is to be considered. The Committee recommend the Secretary to proceed with the printing of the next volume of our proceedings, which will contain the proceedings of the last Annual Meeting at Philadelphia, and of the present one. The custom of the Association has been to print every second year. I move that the recommendation be adopted. (Carried.)

MR. BARRETT—I would like to make the suggestion that volume four correspond with volume three in size.

THE SECRETARY—We have adopted that size as a standard now. I would say, for the information of the new members, that they can purchase from the Secretary the back volumes.

MR. HICKENLOOPER—I desire to say, in addition to what I said yesterday, that, at first, I thought that the application of the principle of charging, as described, viz., the blowing in of the coal, would produce a prejudicial effect upon the retort. In order to demonstrate to me clearly that such would not be the case, Captain Ross first constructed a wooden retort, and cut it in two in the centre, longitudinally, placing the upper half upon the lower, and then projected the coal, by the blast, into the wooden retort. After having done so he raised the upper portion, and the concussion due to the blast was not sufficient to throw the upper half of this wooden retort off the lower half. After having thrown the coal in he then raised the upper half off the lower half, and exhibited the coal laid in as evenly in the lower half as it could be put in by hand, or in any other manner. I was then satisfied that he was correct and endorsed his theory. We took his first experimental machine down to the works. There was an old bench there that had been abandoned. It was going to pieces, and in some places it was so loose you could take the pieces out with your hand. He charged that bench with coal. The concussion was not sufficient to dislodge any one of those pieces in the retort. That was proof positive to us that there was no concussion that would in any manner injure the retort.

THE PRESIDENT—Is there any prejudicial effect upon the benches? What has been your experience in that direction?

MR. HICKENLOOPER—Our experience has been very favorable. It has produced no unfavorable effect upon the benches. If there are any incidental effects, one of them is that it decreases the formation of carbon. I have no occasion, in the retorts that we have been using with the machine, to put in carbon pipes.

THE PRESIDENT—I should like to know something more about the raking machine for drawing the charge of coke. I should like to know whether you can use it when the retort is partially covered with carbon, or when it is irregular, or when it has been shortened. It is sometimes the case that retorts become smaller than they originally were. I should like to know if the raking machine can be used advantageously under the circumstances I have named?

MR. HICKENLOOPER—Certainly. There is no combination of circumstances of that kind that could not be overcome by the use of this machine. It can be put in, for example, if the carbon should be formed to any extent in the roof of the retort. The governing power is such that the rod can be elevated or depressed to any position in the retort. It can be put in six inches and drawn out, or put in two feet and drawn out, or put in its entire length and drawn out. The operator holds the lever which thrusts the rake bar in and out in one hand, and the lever that elevates and depresses it in the other. It is all done by a movement of the hand at the end of the rake.

THE PRESIDENT—I suppose it is well understood that the operator stands on this platform?

MR. HICKENLOOPER—Yes.

THE PRESIDENT—I suppose it is understood that all these movements are made by the men standing on the platform by the use of the levers?

MR. HICKENLOOPER—Are you speaking of the discharging machine?

THE PRESIDENT—Either of them.

Mr. Hickenlooper—On the charging machine the operator stands on the platform, but on the discharging machine he stands alongside of the machine on the retort house floor.

Mr. Starr—What shape are your retorts?

Mr. Hickenlooper—Our retorts are 16×22, ovals.

Major Dresser—You also have D-shaped retorts, have you not?

Mr. Hickenlooper—Yes, D-shaped, slightly rounded at the corners.

Major Dresser—And there you use a D-shaped hoe on the end of the rod?

Mr. Hickenlooper—Yes.

Major Dresser—What is the effect upon the stand pipes of the steam being blown in in this way?

Mr. Hickenlooper—I think it has a tendency to prevent the stoppage of stand pipes. We have had no trouble from that source since we commenced using the machine.

Major Dresser—So far as you have been able to determine, is there any pulsation produced in the hydraulic main from the pressure of this steam?

Mr. Hickenlooper—Nothing perceptible on the gauge.

The President—Would there be any difficulty in using the machine in a retort house without a basement?

Mr. Hickenlooper—None at all. The only difficulty would be that there would have to be an increased width or space between the bench and the side wall of the retort house. This additional room would be necessary for the space occupied by the car in which the coke is thrown. The only change in the machine that would be necessary would be the lengthening of the rake and hoe, the machine having to stand at that additional distance from the face of the retort.

The President—The Manhattan Company, of New York City, I understand, have purchased the right, and are making the machines.

Mr. Hickenlooper—Yes, sir; they propose to operate it in that way and allow room for the coke barrow between the

bench and the machine. I will say that, with us, the coal is never touched by hand or shovel from the time the coal is loaded on the wagon in the yard until the coke is delivered to the consumer, probably miles away. We have a little trackway running into the yard, and a platform car. The bucket forming the body of the car is placed upon that platform, run to the portion of the yard from which the coal is being used, passes over a trackway to the crane, is elevated to the trackway above, placed upon scales and weighed, run in on a two-foot gauge trackway to the bins situated alongside of the retort house. The coal runs by gravity from the bins to the machine, is blown from the machine into the retorts, drawn from the retorts by the discharger, falls into a car situated in the cellar below, which runs on a trackway to the coke elevator, and is dumped into the coke bins; the coke runs by gravity into the wagon of the consumer or dealer, and is carried away. That that portion of coke intended for use in the retort house is deposited in a separate bin, runs by gravity on a buggy on a level with the retort house floor, and is carried to the bench where required for use.

Major Dresser—At the same time do you screen your coke?

Mr. Hickenlooper—Yes, sir; we have a double arrangement for screening, so that we get fine coke or breeze, which we use in our boilers about the works; the nut coke, which goes to the ordinary consumer, and the large coke, which goes to the manufacturer.

Major Dresser—How many hydraulic elevators do you use?

Mr. Hickenlooper—We have two for elevating coal and one for elevating coke.

Morning Session—Oct. 14.

The President—Mr. George G. Ramsdell, of Vincennes, Ind. has a paper on Gas Engines, which we should now like to hear.

Mr. Ramsdell then read a paper entitled

GAS ENGINES.

Mr. President and Members of the Association—I take it for granted that a description of the construction or principles of the gas engine is unnecessary at this time, and therefore have not prepared one; and presuming I was invited to prepare a paper on this subject that my experience, more especially with the large engine in use in our city, might be obtained, I shall to a great extent confine myself to that.

If I am somewhat enthusiastic on this subject, I am satisfied that I am no more so than any member of the gas fraternity would be with a like experience, and no more than is, under the circumstances, justifiable.

I have prepared this paper with a sincere desire that it may contain just the information that may be needed by any gas manager to enable him, in a business-like way, to successfully advocate the merits of these engines, and thereby secure their extensive use; and I have devoted much time and study to secure a fair and just comparison of its merits with those of the steam engine. I also earnestly desire to remove any prejudice, and to draw your attention to facts as they are proved by every-day experience, and not theoretically. I wish to prove to you that not only are small engines, of 2, 4 and 7 horse power, economical, but also engines of greater power, and in the same ratio.

I think you will agree with me that the idea has prevailed to a large extent that, while gas engines were used extensively abroad, their general use in this country, where the price of gas generally rules higher, was impracticable. But is it not also true that where there is a difference in the price of gas, a similar difference in prices of other articles, and especially those that enter into the use of steam, exists? My attention

was strikingly called to this fact by the article in the *American Gas Light Journal* of September 16, 1880, by Mr. F. T. Linton, and read before the North British Association of Gas Managers. By comparing his figures with those I shall lay before you in this paper, you will see that there is just about the same difference in the expense for steam as there is in the expense for gas.

There are two gas engines in operation in our city, and I have prepared figures in each case, which I hope will prove of interest to you.

The purchase of the 17-horse power gas engine, which is of the Otto silent type, was somewhat in the nature of an experiment, as no gas engine larger than 7-horse power had ever been used in this country, and as no gas engine had been used, at least on so extensive a scale for the same purposes—it being used in an extensive grain elevator. For these resons it was almost impossible to obtain reliable data as to the economy or adaptation of this class of engines to the work required to be performed, or any positive guarantee from the manufacturers, except that the engine should be as represented, and exert 17 indicated horse power. However, after much discussion and deliberation it was decided to try it, and I was instructed to procure the engine.

This was done through the Philadelphia agents, who cabled to Germany for it, and in due course of time it was received and erected ready for use.

The engine proved to be of the very finest workmanship and finish, equal to the best locomotive or tool work of this country, differing in general but slightly from the engines manufactured at Philadelphia. The engine is so constructed as to be perfectly automatic, regulating and making its speed perfectly uniform, supplying with oil its various working parts, making it absolutely unnecessary for any attendance except a general supervision such as any ordinary employee can perform. After being started it is left to take care of itself, and does so better than an engineer could do, thus effecting one of its greatest economies—the saving of an engineer's wages. Any employee of ordinary intelligence can do all that is required for its suc-

cessful operation, occupying but a few minutes each day, and scarcely interfering with his regular duties.

When men seek for a motive power, economy in first cost and subsequent maintenance become the principal considerations.

While all who have seen the large engine in operation have admired it, two-thirds of them have been skeptical as to the result of a few gas bills; but I am happy to say to you all that both of the engines in use to-day in the city of Vincennes are, to their owners, who pay the gas bills, more than satisfactory in this as well as every other respect.

Experience has shown positively that the question of economy is no longer in doubt, but is satisfactorily known.

Indeed, in the case of the 17-horse power engine, after four months' constant use, running 16 hours per day part of the time, and covering the busiest season of the year, economy is its chief characteristic.

Therefore, in enumerating the superior advantages of gas engines over steam engines, I would say that they are cheaper in first cost and in subsequent use, and I think I can show to your entire satisfaction that such is the case.

As to the first cost, I find that many persons consider the price, especially of the smaller sizes of these engines, excessive ; but upon careful and intelligent comparison, I doubt if any fair-minded person would hesitate to say that a first-class steam engine of equal capacity and durability, with its necessary attachments, is as expensive in first cost, while in a year's use the gas engine is incomparably cheaper ; and I think I can prove this by a case in our own city, by figures which are actual, and taken from experience with the two engines.

The proprietor of the *Daily Sun*, of our city, purchased a small Baxter improved upright steam engine and boiler, listed at $150, but for which he paid $125. After four months' use, and an outlay of over $40 for repairs, he was forced to set it aside as useless.

He then purchased an upright gas engine of equal horse power, for which he paid $425, and I submit the following comparison of cost.

I stated that his repairs in four months amounted to a little over $40 ; but considering this unusual and excessive, I have calculated the expense for repairs on engine and boiler at $75 per year, and although the engine virtually failed in four months, I have allowed it a life time of good working qualities of five years, and I think these estimates are probably fair. The showing would then be about as follows :

Steam Engine.

Engine and boiler......	$125 00
Repairs, $75 per year, 5 years..................	375 00
Attendance, $182 per year ; for 5 years...........	910 00
Coal, 1½ bush. daily, $41.85 per year; for 5 years	209 25
Kindling, 4 cents daily, $16.48 per year ; for 5 years	82 40
Oil, 12 gal. at 80 cents, $9.60 ; for 5 years........	48 00
•Extra insurance, $15 ; for 5 years	75 00
Total cost in 5 years	$1,824 65

Gas Engine.

Cost of engine..................	$425 00
Repairs, $15 per year ; for 5 years...............	75 00
Gas, $22.50 per year ; for 5 years................	112 50
Oil as above, for 5 years.........	48 00
Total cost of engine in 5 years.......	$660 50
Total cost of engine, 5 years....................	$660 50
Less value of engine, depreciation 33⅓ per cent....	283 34
Net cost of gas engine, 5 years..............	$377 16

Recapitulation.

Cost of steam engine and boiler, 5 years..........	$1,824 65
Cost of gas engine, 5 years......................	377 16
Balance in favor of gas engine..............	$1,447 49

Deducting cost of engine—

Net cost of operating steam engine 1 year..		$339 93
Net cost of operating gas engine 1 year		47 10
Balance............		$292 83
Cost of operating steam engine 1 day......	$1 08	189-313
Cost of operating gas engine 1 day.........	15	15-313
Balance...........................	$0 83	174-313

If any are skeptical, and consider my figures upon any item excessive, please observe that what was paid for a boy engineer exceeded by $532.84 the entire cost of the gas engine for the 5 years. Besides, there is ample room for varying the figures given to suit the prices ruling at any locality.

You will also notice that I have estimated the repairs on the gas engine at $15 per year ; but the fact is, the engine has been in operation daily, except Sundays, for 22 months, and not one cent has been expended for repairs. Bear in mind also that in each case the same conditions prevailed. The gas engine was set in the same place the steam engine occupied, run the same machinery, and was operated by the same persons.

But it may be said that this is an extreme comparison—a good gas engine with a poor steam engine. Very good ; let us see how it would show by taking a steam engine of equal durability—calculating repairs on gas engine one-third of repairs on steam engine and boiler, other conditions remaining unaltered. The life of each engine would now be fifteen years, and the comparison be as follows :

Steam Engine.

Cost of engine and boiler......................	$425 00
Repairs on engine and boiler. $45 per year; for 15 yrs.	675 00
Attendance, $182 per year ; for 15 years..........	2,730 00
Coal, $41.85 per year ; for 15 years	627 75
Kindling, $16 48 per year ; for 15 years	247 20
Extra insurance, $15 per year ; for 15 years......	225 00
Oil, 12 gallons, at 80 cts., per year, $9.60 ; for 15 yrs.	144 00
Total cost of steam engine for 15 years.......	**$5,073 95**

Gas Engine.

Cost of engine.	$425 00
Repairs, $15 per year ; for 15 years..............	225 00
Oil, as above, $9.60 per year ; for 15 years.. ..	144 00
Gas, 9 M, $22.50 per year ; for 15 years....	337 50
Total cost of gas engine for 15 years......	$1,131 50

Recapitulation.

Total cost of steam engine for 15 years.......		$5,073 95
Total cost of gas engine for 15 years...		1,131 50
Balance in favor of gas engine..........		$3,942 45
Deducting cost of plant—		
Net cost of operating steam engine 1 year....		$309 93
Net cost of operating gas engine 1 year......		47 10
Balance in favor of gas engine..........		$262 83
Net cost of operating steam engine 1 day.....	$0 99	6-313
Net cost of operating gas engine 1 day.	0 15	15-313
Balance in favor of gas engine..........	$0 83	304-313

The cost of the same power performed by hand labor was $2.50 per week, costing in the same time $1,950, or $818.50 more than the entire cost of the gas engine and expense of operating.

Now it seems to me that this one engine affords ample illustration to satisfy the most skeptical ; but I wish also to lay before you a comparison of the large gas engine, as used by the Elevator Company, and I think you will agree with me that it affords a still stronger endorsement.

In this, as well as in the former case, I have endeavored to be as accurate, fair and impartial as possible, using, where it was necessary to estimate, my own judgment, together with that of others whose knowledge renders their opinions trustworthy, and taking actual figures in the case of the gas engine.

In my comparison I consider the engines of equal workmanship and durability, and as filling the same place and operating the same machinery, doing the entire work of the elevator during the ten hours of each working day in the year.

Steam Engine.

Cost of 25-horse power steam engine (Corliss)....	$1,320 00
25-horse power steam boiler	615 00
Chimney and britching........................	95 00
Furnace front, grates, etc.....................	80 00
Building for same..........................	475 00
Engineer, $60 per month, $720 per year; for 25 years..............................	18,000 00
Repairs on engine, $40 per year; for 25 years...	1,000 00
Repairs on boiler, $75 per year; for 25 years....	1,875 00
Repairs on furnace, etc., $25 per year; for 25 years..................................	625 00
Replacing boiler 1½ times................	922 00
Erecting engine and boiler, etc.	365 00
Coal, 28 bush. daily, 8,764 per year, at 9 cts.; 25 years	19,719 00
Kindling, one-tenth above....................	1,971 90
Water, $91 per year; for 25 years..............	2,275 00
Oil, 56 gals., at 80 cts., $44.80 per year; for 25 years	1,120 00
Extra insurance, $160 per year; for 25 years....	4,000 00
Total cost of steam engine for 25 years	$54,457 90

Gas Engine.

Cost of 17-horse power gas engine.	$1,385 00
Erecting same..............................	165 00
Repairs, $40 per year; for 25 years....	1,000 00
Oil, as before, for 25 years.......	1,120 00
Gas, 255,000 cu. ft., $511.80 per year; for 25 years..	12,795 00
Total cost of gas engine for 25 years.......	$16,465 00

Recapitulation.

Total cost of steam engine for 25 years...... ...	$54,457 90
Total cost of gas engine for 25 years............	16,465 00
Balance in favor of gas engine...........	$37,992 90

Deducting cost of plant—

Net cost of operating steam engine 1 year....	$2,093 91 3-5
Net cost of operating gas engine 1 year.......	603 20
Balance in favor of gas engine........	$1,490 71 3-5
Net cost of operating steam engine 1 day...	$6 68 307-313
Net cost of operating gas engine 1 day....	1 92 224-313
Balance in favor of gas engine.......	$4 76 83-313

You will notice that in my comparison I have taken a 25-horse power steam engine as against the 17-horse power gas engine, and for this reason : Gas engines are so constructed that they will instantly, and at any time, give out their full actual power, while a steam engine depends entirely upon the boiler for its development of power, and as the generation of steam is in practical use more or less irregular, it follows that it would not be desirable to adopt a steam engine of just the the power required. Thus, in the case before us, had they not purchased the 17-horse power gas engine they would have bought an engine and boiler of 25-horse power.

I have estimated the durability of the engines as equal, and the durability of the boiler at 10 years. In my estimate of fuel I have taken the amount of bituminous coal necessary to supply the Corliss, probably as economical as any steam engine in use to-day. It is also the rule laid down by Professor Rankin in his treatise on the " Steam Engine."

As to the price of coal, I, of course, take the price governing it where I live, and where the engine is operated. I have made no charge for water in the case of the gas engine, it having pumped the small quantity of water it used with the gas consumed, and charged to that account.

I feel assured that you will, upon investigating them, find that the figures are fair and just, and it would seem from them that in economy of first cost, in maintenance or expense of operating, the gas engine has very decided advantages over steam, and as this, I might say, is the vital point in the case, it must be my excuse for dwelling thus largely upon it.

Another important economy is that of space—occupying less space than a steam engine of equal power, while the latter requires the additional space necessary for the boiler, pumps, furnace, chimney, coal storage, etc.

Where the power is located in business houses and other places where space is limited, this becomes an important feature.

There is a great economy in wear and tear, or durability, which is owing to superior workmanship and the fact that all its working parts are lubricated perfectly by simple but effective automatic mechanism.

In the convenience and ease with which it is managed there is absolutely no comparison. In the case of the *Sun* office steam engine, the "devil" himself couldn't run it, and actually gave up his job through fear of an explosion. He now starts the gas engine, and goes to his work leaving the engine to care for itself until the presswork is accomplished, when he stops it.

Another thing I would mention is the economy of gas. Its very sensitive governor adjusts to a nicety the supply of gas to suit the load placed upon it, so that the strictest economy ensues. The maximum of gas consumed per hour per horse power of work, as guaranteed by the manufacturers, is 21½ cubic feet.

In the case of the 17 horse power engine, the most it has ever consumed was while shelling corn, under a very heavy feed, while testing its power, when the consumption was at the rate of 305 cubic feet per hour, and as this was about the full power of the engine, it would show that its maximum was about 18 cubic feet instead of 21½ per hour.

You can scarcely have an adequate idea of the perfect adaptability of this motive power for grain elevators—combining entire freedom from danger of fire or explosion, and, as shown, a great economy over steam.

I have prepared a statement from the Elevator Company's books of the amount of grain handled by the engine during the four months of April, May, June, and July, and having

made accurate tests of the gas consumed to perform the different classes of work, I can give you the exact figures :

18,016	bushels of corn, shelled at .18 cts	$32 45
10,555	bushels of grain drawn up an incline from the river, at 25 cts...	26 38
15,577	bushels of grain fanned and dried. at 22 cts.	34 27
110,720	bushels of grain elevated and loaded into cars, at .07 cts............	77 50
154,867	bushels of grain, at a total expense of......	$170 60

This would be an average expense of $42.65 per month—less by one-third than an engineer's wages, to say nothing of fuel, wear and tear, and danger from fire, etc.

They have been able to start the engine in a few seconds, day or night, and are more than satisfied with the results accomplished.

I am convinced that the gas engine will take the place of any medium sized engine operated by steam, perform the work more satisfactorily and at a reduced cost; especially is this true where the work performed is intermittent. There are very many of the reasons why gas is the chief of all means of artificial light that apply in the same manner to the gas engine—its constant readiness for use being a very prominent one, instead of the slow process of heating a large body of water ; a turn of the wheel and the gas engine is ready to give out its full power.

After a careful study of this subject, I fail to bring to mind a single argument in favor of the steam engine that will stand the test of accurate and impartial comparison. In grain elevators, printing offices, workshops, stores, residences, etc., their instant and constant readiness for work, and their perfect safety, which leaves insurance unaffected under gas engines—the cheapest, most convenient and desirable of any motor known.

Not long since two prominent architects from two of our larger cities visited our city for the purpose of investigating the merits of the gas engine for elevators in ordinary business houses. After they had departed I sat down and wrote to

twelve parties who were using gas engines for the purpose of passenger and freight elevators, inquiring as to their satisfaction, expense of running, etc. I received a reply from each one, in every case expressing complete satisfaction, and strongly recommending the engines for the purpose used—two of them mentioning the fact that in over a year's use they had paid nothing for repairs. Thinking the figures in this branch of work might prove of interest, I have placed them in this paper.

Of the twelve replies, nine were in such a shape that the data could be used; the other three spoke only in general terms as to expense. Therefore I give you the results of nine gas engines in use at the present time for passenger and freight elevators and hoists :

Total number of engines	9
Total horse power	32
Total number of hours used per day	83
Total number of hours used per month	2,158
Total cost of gas per day	$5.27
Total cost of gas per month	$137.25
Average number of hours per engine per day	9.15
Average number of hours per engine per month	240
Average cost per hour per engine	$0.063
Average cost per day per engine	$0.585
Average cost per month per engine	$15.25
Average cost per hour per horse power	$0.0178
Average cost per day per horse power	$0.165
Average cost per month per horse power	$4.29

Add to this small expense the advantages of complete safety, unaffected insurance, economy of space, entire freedom from coal dirt, ashes, kindling, etc., together with the fact that the porter in the store can do all that needs to be done, and that, too in a few minutes' time each day, thereby saving an engineer's wages, and scarcely interfering with his own duties; and it does seem to me that you have the completest, cheapest and most desirable motive power in use to-day.

The gas engine is comparatively a new invention, and has only entered into a very few branches of industry; but there are

new fields developing every day, especially in our large cities, that require just such a power as the gas engine, and with such figures as these, taken from actual every-day experience, it will require but small effort to convince any fair-minded man who stands in need of such power, of its merits. All that is needed is knowledge on the subject, and the rapid introduction of these engines is assured.

The importance of this to the gas interests of the country is very great, especially when it is taken into consideration that nine-tenths of the gas consumed would be in the daytime, when our mains are comparatively idle.

In conclusion, I would say that those who are provided with motive power will in all probability retain the power they now have, although I have shown that a gas engine would be a good investment; but those contemplating the purchase of power, especially for light and intermittent work, can be influenced, and it is with this point in view that I have attempted to prepare this paper, and to embody in it such comparisons and information as can be taken and shown with convincing force to such consumers, resulting in an extensive introduction of these valuable engines.

Applause followed the reading of the paper.

THE SECRETARY—I move that a vote of thanks be tendered to Mr. Ramsdell for his very interesting paper.

Carried.

MR. CARTWRIGHT (of Philadelphia)—I would suggest that Mr. Ramsdell embody in his paper the price of the gas. That will enable comparisons to be made in other places.

MR. RAMSDELL—I did not read it, but it is there. The price is $2.00 per thousand.

MR. H. CARTWRIGHT—The consideration of figures is something which enters into the employment of gas engines in different localities. I am, for one, very much gratified at the economical results Mr. Ramsdell has arrived at by the comparisons that he has made. They are made with such care and thought that they ought to be considered thoroughly reliable.

MR. RAMSDELL—I wish to say a word in reference to the

price charged for gas. The price of our gas is $2.50 per thousand feet, but we had the idea that the machine was going to be an enormous consumer, and we reduced the price to $2.00 per thousand ; but I have since become convinced that that was a mistake. I learn that there is one gentlemen here who sold a gas engine. It is only a two-horse power machine. As an inducement, he gave the purchaser $100 worth of gas, which, according to my figures, ought to run it a year or two. I think it is a mistake to reduce the price of gas at all below the regular price. I think that, considering the economy in the use of the engine, those who have it can well afford to pay the full price for their gas.

MR. LITTLEHALES—What is the lowest day pressure you can run them with ? This is a very important consideration. If it requires a large pressure, of course, the leakage during the time they may be running would be in excess even of the advantage gained by the sale of gas. I find that, with us, it requires about an inch or twelve-tenths. I suppose that will depend upon the pipes, size of the main.

MR. RAMSDELL—My experience was very similar to that. I found, after I had put that engine up, that I had made my connection too small. I ran from my main a two inch pipe, while I should have run the full size three inch pipe. It is volume that is needed and not pressure. They have very frequently run this engine when we have only had twelve-tenths on, but as a usual thing we have had to carry one and four-tenths to make the engine work at times, but that I intend to change. I have known of their being run at eight and ten-tenths, and I am satisfied that, with the proper-sized ten-tenths, is ample to carry any of them.

MR. MCELROY—I would like to inquire if there is any pulsation in the main in the neighborhood ?

MR RAMSDELL—There is an elevator building, which is about 150 feet from the engine, and there is a pulsation in the corner lamp next to the elevator, but there is none anywhere else. We are supplying gas around the same building, but there is nothing within probably 300 feet of this elevator

building which is consuming gas. In that distance we have had no difficulty at all from that source.

MR. BURTIS—You refer to the 17-horse power engine, do you not, as being supplied with two inch pipe?

MR. RAMSDELL—Yes. The other engine was originally put up in the third story; but they subsequently moved it into the basement. I should have done this myself, but I did not know anything about it until the work was nearly all done, and I found that the pipes, while they were ample above, were too small in the basement, and I notified the proprietor that that would have to be changed, and he has acknowledged the reasonableness of making the change. The pipes are only three-quarters of an inch.

MR. BURTIS—What is the size of that engine?

MR. RAMSDELL—1½-horse power. There was one put up at Evansville since, where the gas comes from a four inch main, and that is the one I referred to when I spoke of their running at eight and ten-tenths pressure. That is all they carried, and the engine was working satisfactorily when I last heard from it. I do not think, where the engines are put up properly, that there is any trouble at all in getting them to do their whole work on the ordinary day pressure. I take it for granted that almost every gas company carries at least ten-tenths in the daytime. I have a number of gas stoves on. They could get along with less, but I usually carry about twelve-tenths.

MR. LITTLEHALES—In reference to the pulsation question, I would say that we have with us a four-horse power engine affixed to a main, I suppose, about a two inch one, for about 400 feet. At the inlet of the gas bag the pulsation is perceptible, that is at the gas bag before it enters the engine.

MR. BURTIS—Can you tell me what it costs per day to run that four-horse power engine?

MR. LITTLEHALES—I cannot. It has only been running about a fortnight.

MR. FORSTALL—In regard to the question of pressure, I would say that we have some twelve or fifteen engines at work

scattered throughout the city of New Orleans. I have made no difference in pressure on their account. We run from eight to ten-tenths in the daytime, and we have had no complaints whatever. This question of pulsation has never come up with us. The engines are run from a separate service, but, at the same time, alongside of the service through which we supply gas for illuminating purposes, and we have never had any complaints. These gas engines are giving satisfaction in every case, and we have never had a complaint from any of them. I never have been called upon a second time after the engines were started, even when they were in the hands of those who had never seen one before. After the first day they take care of themselves. We have them running elevators, passenger and freight; we have them in printing offices, in a paper-box factory, running sewing machines, and, in fact, doing whatever work a steam engine can do. Some are in the basement, and others on the third and fourth stories. We put them in anywhere, and they are giving entire satisfaction.

MR. HELME—In regard to a gas engine doing its work as well, and being fitted up better than an ordinary steam engine, I would say that when you come to make that comparison with the Corliss engine, it is a pretty nice discrimination, because the Corliss engines are well fitted up. But a gas engine can take care of itself. I have seen a number of them put up, and I have yet to hear the first complaint from them. We have a promising future in this direction. There is no doubt about that. In the case of one engine that we put up we ran a separate service as Mr. Forstall did. It was a two-horse power engine, and we put in a one inch service pipe, and run it back about 90 feet to the back end of the building. We started running a printing press where they had been using a water motor. They had no steam engine. Everything worked nicely and there was no trouble whatever. We ran it the first day just to see how it operated. We did not do any work with it. The next day I gave up the control of it to a man who was not familiar with machinery, but he had no difficulty in running it. There was one little difficulty that occurred, but it was speedily remedied. After I left they did not attend to

the engine very well, and after a few weeks constant running, some of the passages clogged up a little, but that was remedied, and that is the only interruption they have had. We run along very well, with about eight-tenths, and have no complaints at all. In fact, if you have just pressure enough to overcome the friction in the pipe leading to the engine, the engine itself will work well, sucking, as it were, gas from the main with almost no pressure. I have no fear of the gas engine. The only thing is that there are a good many people who would like to try it, but they are just a little afraid. I think, however, that after a while it will become more popular than the steam engine for anything under 15 or 20-horse power.

MR. FORSTALL—I should like to state that I have used the gas engine to take the sting out of the electric light. The keeper of a large saloon who had determined to introduce the electric light came to me and asked me as to what I considered the best engine to use, and I succeeded in getting him to use a gas engine as his motor power. So that we may console ourselves with the thought that even if electricity does take away some of our large customers, we may still sell them gas to produce their electric light. [Applause.] I have put the consumption of these gas engines at 20 cubic feet per horse power, per hour. That is about the average.

MR. STARR—That would be 80 feet an hour or 800 feet a day.

MR. FORSTALL—That is with the engine working at its full power. We have found that where the engine is working at its full working power, it will generally explode with every stroke. But when the power is thrown off and the engine is merely in a condition to operate, it will run some 15 strokes before an explosion takes place, so that the work is automatic. The consumption of gas is in direct proportion to the amount of work that the engine is doing, up to its full power.

MR. SOMERVILLE—In a little town in our State, Rushville, they had a small gas works. A party put up a gas engine, and turned the gas on, but it would not work. They asked me what was the matter with the engine. We were running gas

engines at the time. I thought that, perhaps, the high specific gravity of the gas they used might account for it, and that the orifices which admit the common coal gas into the explosive chambers would not admit the high specific gravity gas in sufficient quantities, and that, therefore, the proper mixtures did not take place. It may be that, and it may be, perhaps, that their oil gas is not sufficiently purified, and it may have clogged. I thought it might be interesting just to state this fact.

MR. RAMSDELL—I sold that engine to the parties in Rushville, and I sold, at the same time, an engine for an elevator in Evansville. The two engines were imported from Germany and came here together. They are just exactly alike. The engine at Rushville was sold with the perfect understanding that if it did not work it was to be taken back. The Philadelphia firm, to which they belonged, had not expected them to be operated by gas made from oil, and they were anxious to try the experiment. For that reason they made him that proposition. The house sent a man to put the engine up. He did so, and he found, as Mr. Sommervllle says, that the gas was too heavy for the machine to operate successfully. The gas should come from the slide valve and ignite. In this case it failed to do so. The consequence was that there were two or three admissions of gas before it would ignite and explode, which would not be economical. The correspondence has all been conducted between the firm at Rushville and myself, but of course I have been instructed by the Philadelphia house all the way through. We had decided to take the engine away, and I so wrote to the gentleman at Rushville. He then wrote, making a proposition for the engine. He said he would pay so much, and wanted to know if we would accept that sum, provided he could make the engine work. In the meantime I had written to the superintendent of the gas works there, thinking that, perhaps, there might be some trouble with their pipes or their pressure. He wrote to me, and I received the letter in the same mail that I received the one from the Elevator Company, saying that he had been there a number of times, and that the engine was working all right every time he had been there. He had seen no trouble, although the engineer,

or the man in charge, told me that sometimes they could not make it work satisfactorily. Since I have met one of the members of the Philadelphia firm, and he informed me that the proposition of the Rushville parties had been accepted, and that in all probability they would retain the engine. He also informed me that they are beginning some experiments on the slide valve. They think that for oil gas there should be a larger opening, so that there will be more room for the gas to penetrate, and thereby secure an explosion.

MR. WEARE—I have been thinking over the figures that I have heard here upon the cost of motive power, and I have come to the conclusion that where there are water works, and the water is cheap, they do not compare favorably. It has occurred to my mind that it will take about 1,000 feet of gas to run a 4-horse power engine a day. That would be, at the lowest estimate for gas, about $2, and from that all the way up to $3.50. The average would probably be about $2.50. Water beats that. For my printing office, running two cylinder presses and two Gordon presses, I have all the power I want for $300 a year. Therefore I do not think, unless it is in those localities where gas is remarkably cheap, that gas as a motive power can compare with motors run by water. I am satisfied that in our region it cannot, because I get all the power I want for $300 per annum, and I can run day and night, if I desire, and every day in the year. I use the direct pressure from the city works. As a matter of course, the machine costs but very little—about $150.

MR. CARTWRIGHT (Philadelphia)—Do they allow you to run the machine day and night at the same price?

MR. WEARE—Yes; I made a contract with them.

THE PRESIDENT—That is most extraordinary.

MR. WEARE—I have all the water I want at so much a year.

MR. LITTLEHALES—Are they gravitation water works, or is the water pumped?

MR. WEARE—It is direct pressure from the works.

MR. CARTWRIGHT—Is the water pumped by steam?

MR. WEARE—Yes, sir.

MR. HELME—I hope Mr. Weare will not mention that so much in the town he comes from. In a place where I have a gas engine running a printing press they raised the water 330 feet, and they gave him an elevation of 40 feet besides. When they came to put the meter on they found that the water company was losing about $4 a week over the actual cost of pumping the water. That is what put the gas engine in. I think that if they put the meter on your apparatus the same result will be discovered.

MR. WEARE—They have done that already. They formerly furnished me for $250; but they put the meter on and raised me $50.

THE PRESIDENT—Of course, yours is a special case, and cannot be cited as being of general application. It probably does not apply to any other city in the world. I am sure that in our city they would not allow you to run twenty-four hours at the same price they would six, and I do not believe any well managed corporation would.

MR. WEARE—They get a good compensation for their water.

MR. HELME—To what height do they raise the water before it reaches you?

MR WEARE—My power is on the first floor.

MR. HELME—Are you pretty low down toward the level?

MR. WEARE—I am perhaps a little low.

MR. HELME—That is another case altogether. It makes a great difference, placing your motor down on the level that they elevate the water from. You get the benefit of every foot they raise. In the case I speak of they actually raised it 300 feet before we got one pound of pressure to operate the motor, and it was necessary to raise it about forty feet higher before the motor would run. There were three motors in the building, all running printing presses, but when they put two of them on neither of them would run, and when they put on three they would have to compromise with each other and make arrangements for somebody to stop while the others went on.

THE PRESIDENT—That city is a small one, of course, with a

good deal of power and a good deal of capacity above the necessities of the town. In Cleveland they will not do a great deal of business in the way of selling water. They have not got the water.

MR. RAMSDELL—I will say that these parties who are using the engine in Evansville also have water power. I am not very familiar with the different kinds of water power, but whatever they had they have set it aside and put the gas engine in its place.

MR. HELME—Did you ever compare the actual power obtained from them with what the makers claim for a steam engine?

MR. RAMSDELL—No, sir, I have not.

MR. HELME—Do you think that you obtained 17 horse power from your engine?

MR. RAMSDELL—I could not say; I do not know how that is.

MR. HELME—You have no means of comparing it with some other elevator in that neighborhood?

MR. RAMSDELL—That is the only elevator there. The engine does all the work. It runs a large corn sheller, and drags the corn about 300 feet, which requires more power than the sheller does. When we were estimating the power necessary, we were calculating for the sheller itself. We made no figures on the drag. But we found that it did all the work successfully in both cases, and did both things at once.

MR. HELME—I am pretty well satisfied that you get all, or very nearly all, they claim.

MR. WEARE—I would like to inquire why it is that there is so much difference between the cost of a gas engine and the cost of a steam engine. I can purchase a steam engine, say of 4-horse power, complete, for $350. Now, the gas engine costs more than that. It costs, I believe, about $400. I rise to ask why it is that there is such a difference in the cost. Certainly, one has the expense of a boiler, and the other has no boiler.

THE PRESIDENT—Do you mean to include the boiler when

you say that you can purchase a four-horse power engine for $350.

MR. WEARE—Yes, sir ; I can get a four-horse power engine, all complete, for $350.

THE PRESIDENT—New ?

MR. WEARE—Yes, sir.

MR. HELME—I have thought that matter over a good deal, for I have a lively interest in the engines. In the first place, these gentlemen have to pay a very large royalty. Besides that, there was a large amount of money spent in making experiments, and getting the engine down to its present condition. It was at first imperfect, and a great deal had to be done, and much money had to be spent to make it what it is. They tell me that the company that bought out the patent, paid the man for all the expense he has been to in experimenting, for these many years. Another thing is that Mr. Ramsdell compared the engine with the Corliss engine, and spoke as if it were fitted up in a superior manner. I call that in question.

MR. RAMSDELL—No ; I don't think I said that.

MR. HELME—I so understood it, but perhaps I am wrong. There is another thing about it. A gas engine is propelled by explosion; consequently, it requires stationary rods and stationary bed-plates, perfectly fitted. A steam engine, as we all know, receives the steam slowly, and the strain is very much less sudden and severe than in the case of the gas engine. Therefore, I think that the cost of the gas engine is largely due to the workmanship that is required. It is something like an engine that they are now running in Philadelphia. It is what they call a high speed engine. They are large engines. I saw one at Johnstown the other day. It was four feet stroke, and made 125 revolutions per minute. They told me that it had not cost a dollar for repairs in two years. They are very fine engines. I must say I never saw superior workmanship or better designs than I saw on those engines, simply because they are put to such a severe test that they are obliged to have the most careful work upon them.

THE PRESIDENT—It is very difficult to institute a compari-

...-horse power engine for $350; ... account the labor, repairs, etc., ... I have heard of an engine ... which proved to be very dear ... that this $350 boiler and engine ... the long run, compared with an ...

... ke to say just one word upon this ... engine is largely owing to the ... has suggested In the case of the ... cost is $1,385. The cost of the ... $1,320, without the boiler, or ... things—just the engine alone. So ... ference of $65 between the two en- ... power engines the difference in the ... ttle, and the difference in material is ... a large engine is heavier in all its ... een suggested, the effect of the explo- ...

... would like to state a fact that took ... who brought all his machinery and ... employed, from Cincinnati. He left his ... ght all his other things with him; and, ... a happy foresight. The power that it ... ery was a one-horse power. A question ... a gas engine of that capacity would run ... we were led to try it. We fixed him up ... his machinery, and it worked admirably. ... been much interested in listening to Mr. ... to the statements of those who have ... gas engines for motive power; but I have ... something from these gentlemen in regard to ... these engines in their exhauster rooms. It ... they are very ready to induce others to use ... are not so ready to use them themselves. ... supply gas to other parties they charge a ... they could use the engines in their works as a ... would simply have to charge at the rate the

gas cost. I would like to inquire of Mr. Ramsdell, or Mr. Forstall, or any of these gentlemen who have been disposing of gas engines to their customers, if they have used them themselves in their exhauster rooms, or anywhere about their works for motive power?

Mr. Ramsdell—So far as I am concerned, I have studied the matter over very thoroughly. I wanted to put one in; but I wrote to the parties who made our exhauster, and they told me that they did not think it would work steadily on account of the fact that the gas engine runs at a continuous speed. There would be no variation to accommodate itself to the exhauster, and I gave the matter up. At that time we were expecting to crush our coke, and I intended to put up one of these gas engines, but we made a contract with the parties who took our coke, and we have nothing to do with it. Apart from the use in the exhauster room, if I had an opportunity to use it, I should certainly do so.

Mr. Neal—When I have conversed with people about these engines I have always recommended them; but I am met by the inquiry if I am using them in the works under my charge. I have given the same reason that Mr. Ramsdell has; but that does not seem to satisfy them. It seems to me. with all the improvements in gas engines, some arangement could be made by which we could run our exhausters with them. We have two engines in our exhauster room, of five-horse power, which I would be very glad to substitute gas engines for, provided they would work satisfactorily, and run the exhausters so as to take the gas as it came and accommodate themselves to the volume of gas passing through them. I hope that these gentlemen will consider the matter and endeavor to find some method by which it can be done. We would then, I think, have much more influence and success in persuading others to use them. We could say to them that they are operating very successfully at our works, and that we would be glad to have them call and examine them. We should then be far more likely to induce people to take them. That would certainly be the case in my district. When I tell our people why we do not use them, they are not at all satisfied, and they rea-

son in this way; if they do not use them at the gas works it must be because they are more expensive than the steam engines, or there must be some trouble about it.

MR. LITTLEHALES—I think the objection to adopting gas engines in exhauster rooms is self-evident. As a general rule, breeze from coke is valueless when offered for sale; but it becomes very valuable fuel to the company itself. In our case we use for fuel the small breeze from the coke heap. It would be valueless if offered for sale, but it is of great value to us to use as fuel.

I do not think there would be any practical difficulty in running exhausters with these gas engines, because, although they run at a fixed speed, a properly adjusted compensator would get over the whole difficulty. It is a practical question, however, of having the fuel on hand. Most gas companies, like ourselves, have, I suppose, a large amount of material already on hand that is valuable for fuel, but which, if not used for that purpose, would not be worth a dollar.

MR. HELME—I do not think that accounts for it. I think there is a mechanical difficulty in the way. That matter has, undoubtedly, occupied the attention of every mechanic in the Association. I have thought about it a good deal. The matter has been before the attention of gas engineers in England. There is a real practical difficulty in the way of making it work as satisfactorily as a steam engine. This uniformity of speed is the trouble that must be overcome. I think it is 180 revolutions per minute that they are rated at. The engine does not take gas at every revolution, or every other revolution. It takes no gas until it gets below that. Now, the difficulty is to get a varying movement from that fixed speed, which will accommodate the exhauster to the amount of gas being made and being brought forward. Some gas engineers of London have adopted a device with a sliding arrangement, which slides over a large diameter; but it seems that even that does not work satisfactorily. It does not operate quickly enough. We are going to charge two or three benches of retorts. We have got to where there is no gas coming, but the machine is working rapidly. Presently, a large volume of gas

is sent forward to the exhauster, which the exhauster cannot take up quickly enough. With a steam engine this is easily regulated, and with but little variation. There are many exhausters which run from one end of the year to the other with scarcely any variation. There is a purely mechanical difficulty which Mr. Littlehales has not accounted for at all, and here is a field for Mr. Neal, and others, to exercise their wits upon—to devise some mechanical contrivance that will overcome the difficulty.

MR. LITTLEHALES—The best answer to that argumunt is that within the last four or five years they have been using quite a number of gas engines for running exhausters.

MR. HELME—I am glad to hear it.

MR. LITTLEHALES—It is being done; and I do not think there is any serious practical difficulty in the way. Of course, if the works are so conducted that a number of retorts are charged at once, and then there is quite an interval when there are none charged, I should consider that a defective arrangement, and should think it not improbable that some trouble might arise. But that is a defective arrangement in regard to charging, and is not a mechanical difficulty.

MR. HELME—I have not before heard that the gas engine has proved satisfactory across the water, when used in the exhauster room, though I am certainly glad if it is the case. I have known of its being applied to exhausters over there, and of their attempts to make improvements that will obviate the difficulties I have referred to; but all the information I have upon the subject is to the effect that, even with the improvements they have introduced, it does not work satisfactorily when applied to exhausters, and I do not think that the mechanical difficulty which I believe is inherent in the machine has yet been entirely overcome.

MR. STARR—I think the difficulty might be obviated by having a compensator, so that when that large volume of gas comes it will close itself automatically.

MR. HELME—It is not economy in the right direction to introduce a thing which requires to do as much work when you are working a little gas as when you are making all you can.

... you may have to do it.

... that compensators would be ... gas engines that were running

... a little further in regard to a ... We had a communication from a ... use of the machine very expens- ... of the engines in use in our ... thing which I think will overcome ... sonable. So far as the compensa- ... that we used a governor in crush- ... perfectly. I cut off the governor ... on the compensator, and the gauge ... the compensator than with the gov-

... I say, in regard to this matter, that ... having made all their arrangements ... engine, being obliged to use a large ... eating their works, and they have gone ... same time recognizing, in many cases, the ... ngines in many respects. Take my own ... Years ago our works were fitted up with ... and we were obliged to run them when we ... ere the directors are willing we should ... gineers and managers of gas works cannot ... they would like in the way of introducing ... ectors have to be considered. So far as my ... advocating the introduction of these engines ... I have met with no objection on the ground ... sed in our works. That is the difference be- ... Boston. Boston people are much sharper, ... corner Mr. Neal in that way. But they do ... that manner in Cleveland. We are about to ... power gas engine in our works, and it may ... gument in the way of inducing other people ... great difficulty and the great bugbear with our ... of the gas. They are afraid of their gas bills. ... with any more serious objection than that.

Mr. Neal—If you were able to tell your people that the engine was employed in your works, and to show them results, would you not be more likely to induce them to employ it?

The President—Perhaps so; but, as I say, I have never been met with that objection.

Mr Starr—I would like to inquire whether you have had any complaints from parties for whom you have put in these engines?

The President—Last spring a party wanted us to put in a gas engine for the puspose of elevating. We were in negotiation with two or three firms in regard to it, but we could not get the right sort of engine in time to meet their demands. Some mechanics who got hold of the job succeeded in making the party believe that a two-horse power engine was sufficient to run the elevator. I told him that it was not, but he insisted that he knew all about it. He put it in, but it did not prove to be sufficient. It had a dampening effect for a time, but we put a 4-horse power engine in, and they are running it now.

The Secretary—As this matter has apparently been discussed at sufficient length, I desire to call the attention of the Association to another matter. I have, during the past year, been notified of six members of the Association, as I stated yesterday, but I did not then announce their names. It seems to me that it is simply a matter of duty upon our part to take some official notice of the death of these gentlemen. I now respectfully notify the Association of the death of Mr. John O. Buxton, who died July 21, 1880, of Mr. George Buist, who died November 2, 1879, of Mr. George W. Edge, who died January 1, 1880, of Mr. Lazarus Noble, who died in June, 1879, of Mr. O. G. Steele, who died November 11, 1879, and Mr. Kerr Murray, who died in the spring of 1880.

I would respectfully move you, sir, that the first hour of the evening be set apart for any obituary remarks that the members of the Association may desire to make, and that the same be incorporated in our minutes. Mr. Page was to talk to us to-day upon the subject of coal tar and its products; but he has consented to take the evening session for his remarks. He will then have an opportunity of showing you the answer to

the question that is not infrequently asked of how aniline dyes stand electric light and gas light.

MR. CARTWRIGHT (of Philadelphia)—There was a subject laid upon the table yesterday, and that was a proposed amendment of the Constitution in regard to the time of meeting. I move that that matter be now taken up and disposed of. (Carried.)

THE SECRETARY—As it stands upon our minutes the proposition is to amend the seventeenth article so as to strike out the word "October," and insert the word "May," making the annual meeting the third Wednesday in May instead of the third Wednesday in October. An amendment was offered, changing this to September, and the original amendment, as well as the amendment to the amendment, are open for discussion.

MR. STARR—I think that amendment was withdrawn.

MR. DENNISTON—I understood that my amendment was amended.

THE SECRETARY—General Hickenlooper offered an amendment making it April.

THE PRESIDENT—That question is now before us, and I adhere to the ruling of yesterday that the resolution may be amended at this time.

MR. DENNISTON—I would simply state that I advocate the latter part of September, because that is at a time when we can be more readily spared from our business than at any other time, or a time when we can get away better than we can in October. As suggested by the Committee, May is a very good time to be away from our works ; but there are other Associations which have already fixed their time, because this Association has heretofore met in October. Of course, it will not be necessary for the National Association to give way to the other Associations, but it would be well for us in fixing upon a time, to fix it definitely and permanently, so that the other Associations throughout the country can, also, have a fixed time, and so that they will know what they are doing when they change their constitutions to meet the present emergency.

THE PRESIDENT—The specific question now before us is upon General Hickenlooper's amendment to your amendment. His proposition was to amend your amendment so that the meeting should be held on the third Wednesday of April of each year.

MR. WILLIAM CARTWRIGHT—I hope, for one, that the amendment will not pass. Our year closes the first of April, and that would prevent me from attending the meeting in that month. So far as I am personally concerned, if there is to be any change at all, the month of May or the month of September would be preferable.

THE PRESIDENT—I very much question the expediency of fixing the time for our meeting in April, for the reason that in the more northern sections of our country the snow has not left the ground.

MR. SPENCER—I hope that the time of the meeting will be left just where it is. I think, taking all the circumstance surrounding it into consideration, we cannot do better. I am certainly opposed to taking as early date, as the month of April.

Upon a vote being taken, the amendment of General Hickenlooper to the amendment of Mr. Denniston was lost.

THE PRESIDENT—The question now is upon the amendment of Mr. Denniston making the time of the annual meeting the third Wednesday of September.

MR BURTISS I think the third Wednesday in September is objectionable for one reason. The superintendents of many of our small companies have to be at home about that time. Our bills are made up to the first of October. I think an earlier day in September would be very much preferable than the third Wednesday.

MR. BUTTERWORTH—I think it is much better to keep the meetings as they are now. It has worked very well thus far, and I see no reason for a change. I suppose it would be inconvenient for some of the members to attend no matter when the meeting was held. I do not, however, object to an earlier date so far as I am personally concerned. In reference to our

Western Association I will state that when, in its early days, this Association fixed its place of meeting in the City of New York, some of us out here could not very well afford to go, and we got up a little society of our own and fixed the time of meeting in May. We do not get to work until after the 4th of July. It would suit us better to have the time early in the spring; but if it is to be in the fall, I think it would be better to let it stay where it is.

MR. STARR—If we fix the time in September we are likely to be troubled with very warm weather. It is, for that reason, a very unpleasant month to be away from home.

MR. DENNISTON—I do not wish to insist upon a change to September. My amendment was simply a compromise. There are a number I know who are opposed to having the meeting in May. For my own part, as I have said, it would suit me as well to have the meeting in October as at any other time, and I suppose a large number of us could attend as well in October as in September; but if there is to be any change at all I, for one, do not want the time fixed in May. I should greatly prefer September, and I should rather have it in October than in May.

THE PRESIDENT—I remember that when the time was fixed in October there was a good deal of discussion, and, at that time, it was thought to be the best date, on the whole, that could be fixed upon. It suits our New England friends remarkably well.

I should like, at this point, to make an explanation of the change in the time of meeting this year. The regular time of meeting was the 21st of October. I corresponded with the President of the company in Chicago, who was chairman of the Committee of Arrangements, in regard to the matter. He wrote to me repeatedly that it would be very inconvenient to have the meeting held here at the regular time. He said that there were other associations to meet here at that time, and it would be difficult to get the proper accommodations at the hotels, and that, as for himself, it would be very much more convenient for him I did not feel at liberty to change the Constitution, and I corresponded with the members of the

Executive Committee, and they all approved of bringing the meeting forward one week. It is clearly an impeachable offence, and I plead guilty to it; but, perhaps, under all the circumstances, it was the best thing that could have been done. I am, however, very sorry to learn that it has been the cause of keeping many of our New England friends away from this meeting. This explanation is due to the Association in order that the members may understand why that liberty was taken with the Constitution. The question now is upon Mr. Denniston's amendment.

MR. SOMMERVILLE—I am opposed to the change. One reason is that the American Gas Light Association is an established fact, and we ought to arrange our work so that we can attend the meetings at the time fixed by the Association. I do not like the idea of changing. It looks like a want of stability. If we change now we may want to change again by-and-by. For my own part, I can get away better then than at any other time, for during the spring and summer work, is going on that requires my special attention. In October everything is prepared for the winter, and I can leave better then, than at any other time of the year.

MR. PARKHURST—There seems to be a good deal of difference in regard to this matter which does not seem to me to be very important; and, in order to test the sense of the Association, I move you, sir, that action upon this matter be indefinitely postponed, and thus leave the matter just where it is. [Lost.]

THE PRESIDENT—The question is now upon Mr. Denniston's amendment, which, I believe, is well understood by all.

Upon a vote being taken, the amendment was lost.

THE PRESIDENT—The question now is upon the amendment proposed by the Executive Committee, substituting the third Wednesday in May.

Upon vote being taken, the proposed amendment to the Constitution was not adopted.

THE PRESIDENT—We will now listen to Mr. Weber upon the subject of "Gas Furnaces."

Mr. Weber then spoke as follows :

Our Secretary has stated I was to read a paper; but, owing to a slight misunderstanding, I have not been able to prepare one. I have, however, some drawings with me of gas furnaces of various descriptions, which I would be happy to exhibit to your attention.

You are, of course all aware that Siemens was the originator of the use of gas to any extent in the manufacture of iron and steel. When he had achieved great success in this direction he woke up all the scientific and practical men engaged, not alone in the manufacture of iron and steel, but in other industries. It stirred them up as the electric light did the manufacturers of gas a few years ago. It has employed the thoughts of men of science for the last fifteen years to make the use of gas a success in other branches of manufacture. There are now some fifteen or twenty scientific men devoting their time exclusively to the work of making gas available for other purposes, with whose names you are probably more or less familiar, such as Muller & Eichelbrenner, in retort benches; Muller & Fichet, in regenerating bone for refining and clarifying purposes, and also in applying gas as fuel to boilers; Steinmann, in gas generators and in the manufacture of wood gas; Lendin, in the use of sawdust as fuel; Boetius, in the manufacture of crystal and window glass; Steinmann, in connection with lime-kilns; Hodeck, in gas as a fuel in the production of carbonic acid; Mehse, in the manufacture of porcelain; Moller & Mendheim, patentees of gas kilns for the Royal Porcelain Manufactory, Berlin, Germany; Buhrer, in the manufacture of terra cotta ware, fire bricks, etc.; Mohr, of the Continental Gas Company, Stettin, Germany, in retort benches; Liegel, of the Stralsund Gas Works, Germany, in retort benches; and in the application of gas as fuel to boilers; and Dieterich, of the People's Gas Light Company, Baltimore, Md., in retort benches.

These men have expended considerable time and money in the production of furnaces of different constructions, as best applied to the uses and purposes intended. As before stated, I have some plans of improved gas regenerating furnaces, showing their construction in detail, and of which there were

two erected last year at the Metropolitan gas works, in New York City. They are known as the Liegel Furnace, and patented in Europe and the United States, by Liegel of Stettin, Germany. His authorized agents for this country are Messrs. Eppelsheimer & Huttner. These furnaces were put up with the understanding that they were not to be accepted if they did not perform their work satisfactorily. The same company has contracted with me for the erection of twenty-four of these furnaces this year (applause), and have paid me for those put in last year without a word of objection. These twenty-four Liegel furnaces, and two on the system of Muller & Eichelbrenner, the latter improved upon by Mr. Strecker, assistant superintendent of the works, were built in the same stack of benches, and will be fired up in two or three weeks. The patentee (Liegel) guarantees that 17 to 18 per cent of the coke carbonized is sufficient fuel, and not only that, but also guarantees that the furnaces will produce a higher heat than those on any other system. Some of the advantages claimed for this furnace over the old grate furnaces are as follows, as set fourth in the pamphlet:

1st. Saving of about 50 per cent in fuel when compared with ordinary grate furnaces, using the same kind of coal, having the same number of retorts, and producing the same amount of gas.

2d. Any degree of heat can be obtained. By this the productiveness of the retorts can be increased as far as the illuminating power of the gas, the quality of the tar, or the material of the furnace will allow.

3d. Greater durability of the furnaces, as the walls and the fused slag do not come in contact.

4th. Automatic cleaning of the fire from the slag, by the fusing of the latter, which lessens the labor of the firemen.

5th. Abolition of the grate.

6th. No water required in the ash pan.

7th. Continuous or intermittent firing, as desired. There is no necessity for drawing the fire, even for stoppages of 72 hours' duration, during which no watching is required.

No strong draft is needed. The dimensions of the old grate furnaces and retorts may be retained in replacing them with the Liegel furnace. The depth of the generator furnace below the floor line is from 5 to 7 feet. The deeper ones are worked more advantageously.

The pamphlet also contains reports of working results of furnaces, constructed on this system in 1879, in England, France, Germany, Russia, Sweeden, Italy, and Hungary.

Here are plans showing the construction of a gas generating furnace on level ground, and within two feet of the surface. This furnace is to be recommended in cases where an underground furnace would be impracticable, owing to water. They can be constructed in any part of the retort house, and even outside of same, should the retort house be too small, or so located that the furnace cannot be attached to the benches, and the gases drawn into the benches as shown on the plans. They will be found very adaptable in small works, where they can be attached to the side or rear of existing benches without disturbing them in the least. Where the erection of a new stack is contemplated, the best position for this furnace would be in the centre of the stack, or on both ends, from which the gases could be drawn into the respective benches in use.

In the construction of this furnace it would be necessary to carry up the height of the chimney on the generator to 15 or 20 feet, in order to insure sufficient draught. It would also be necessary to carry up the height of flues on the top of the benches to at least 10 feet, which additional height could be provided by means of a removable (at will) sheet iron pipe. The idea is to furnish sufficient draught to commence with, and when the desired heat is attained the extra length of pipe can be dispensed with. In the Liegel or underground furnace no necessity exists for any increase in height of flues, and, the heat remaining in the bench, there is no loss of heat by radiation, whereas the overground generator, unless built directly in connection with the benches, loses heat by radiation in traveling the distance between benches and generator; although, under this disadvantage, it claims a saving of 30 to 35 per cent, as compared with the old system of firing by distinct

furnaces for each bench, in economy of fuel, higher heats, and increased durability of retorts and settings.

If the members of the Association will ask me questions I shall probably be able to explain the matter to them more satisfactorily.

In Europe to-day the system of heating with gas in continuous furnaces is almost universal. Mr. Mohr, of Stettin, Germany, whose company has works established in some seventeen cities and towns in Germany and Russia, has adopted this overground furnace system in the most of his works. Mr. Buhrer, of Konstanz, Germany; has put up over 200 furnaces on this system within the last few years, and he writes me that he has some forty men erecting them all over Germany, France, Italy and Switzerland, not alone in the gas industry, but also in glass, porcelain and terra-cotta works. I carried on correspondence with Mr. Mohr quite a number of years ago, and wrote him that some of our gas companies could not dispose of their coke that they made under the old system to advantage, and on account of the increased production of coke under the new system, it would be a still greater drug on their hands, and on that score would not take hold of the furnaces. He replied to me that it would still pay the companies to use the new system, even though they should be compelled to sell their coke at a disadvantage, or be forced to give it away.

I erected two furnaces on this system in a chemical works in Brooklyn, which are now working very satisfactorily. I think I will have one in New Haven for Mr. Sherman, and also some more in Brooklyn.

Here also is a plan showing the Liegel furnace in connection with a steam boiler, which is to be erected in the sugar refinery of Messrs. Havemeyer & Elder, in Brooklyn, conceded to be the largest sugar refinery in the United States. We have agreed to erect this furnace under the condition that it shall evaporate 12 pounds of water per pound of coal.

The patentee's pamphlet reports a test made in Switzerland, under a boiler having 435.57 square feet of fire surface. After having passed around the boiler, the hot gases pass around two mud-drums, with 242.74 square feet of surface exposed.

...e drums is 65.3° F. Steam
... coal. The boiler had for-
... aporated 7.26 pounds of water
... ng changed the fire-place or fur-
... his generator furnaces, without
... work, a trial of 360 hours was made.
... all other circumstances being the
... ound of coal, which represents a
The feed water was measured by a
... Halske, made for this purpose, and
... (about 2½ gallons).

... erly taken care of, will work satisfac-
... s without necessity of renewal, and the
... rmly heated than by the old furnace,
... with less production of carbon and tar,
... olonging the life and durability of the

... gainst my personal interest to say this, be-
... n, and quick to see objections and disad-

... is near at hand when all fuel will be con-
... that it will be used to much better advan-
... heating in gas works as well as in other
... any desired intensity of heat can be attained,
... case with furnaces of present construction.
... is that any kind of coal, coke or carbon-
... an be used.

... been favored with the quantity of coal that
... country, and the Europeans have been com-
... their material in the best possible way, and
... to utilize it in such a way as to produce the
... results. I venture to say that in five years from
... will have become so thoroughly convinced of the
... system, that you will have adopted it almost

... on you desire I shall be most happy to fur-
... have a number of plans with me that I shall be glad
... examine, and I will cheerfully explain them if they

need explanation. I feel that an apology is due the Association for these somewhat disjointed and discursive remarks, and if I have failed to make myself understood by some of the members, I shall be happy to explain to them in person.

THE PRESIDENT—If there are any points in regard to which any of the members of the Association are in doubt, they can now proceed to question Mr. Weber in relation to them.

MR. WEBER—I will say that improvements have been made upon these furnaces from year to year, until they have reached their present point of perfection.

MR. ALLEN—I would like to inquire of Mr. Weber if he knows what royalty these parties ask for their process.

MR. WEBER—The royalty which they charge the Metropolitan Gas Company is $100 per bench, and the Company has the privilege of replacing these benches as often as they please without further charge. I think they will raise the royalty to $200 per bench, or they will arrange it in this way: They say, "We will take your statement of your works for the last year, and we will take half of the proceeds of what we can do for three years, and you will pay us at the end of each year for that year's work." That is very little. That is the understanding I have had with them.

MR. CARTWRIGHT (Philadelphia)—How long has the Metropolitan Gas Light Company used these furnaces?

MR. WEBER—They were built last year. I built them at my own risk, because I could not get any-one to use them in any other way. They were put up subject to the approval of the President and Engineer of the Company.

THE PRESIDENT—Mr. Cartwright's inquiry was as to how long the furnaces have been in use in the Metropolitan works.

MR. WEBER—Since last July, and they have been working satisfactorily.

THE PRESIDENT—If there is no further discussion of Mr. Weber's remarks, the Secretary will now proceed to read a paper prepared by Mr. Edgerton.

MORNING SESSION—OCTOBER 14.

The Secretary then read a paper by Mr. Edgerton entitled

SELLING GAS ON AN ILLUMINATING BASIS.

It is difficult to speak of gases quantitatively in any other way than by the cubic measure ; hence the selection of cubic measure as a basis of price and sale. The invention and introduction of the gas meter as such a measure, were indeed steps of vast importance in the advancement of gas lighting. The manufacture of gas could have made but slow progress without it. The meter has been perfected ; it is now a most accurate instrument ; but, as it became mechanically more perfect, the anomalies of the cubic foot as a basis of price became more apparent. Most of these anomalies, it is true, are only apparent, not true, arising from the rather excusable ignorance of consumers in regard to meters. Others, and, unfortunately, the most serious, are founded on fact.

The difficulty in regard to meter measurement, is that it is based upon quantity alone, and quality is lost sight of. Now, the value of gas is dependant not only upon a combination of quantity and quality, but they are exactly convertible terms. For instance, of 15-candle gas, 5 cubic feet per hour is required to give a 15-candle light, whereas of 30 candle gas, but 2½ cubic feet is required to afford a 15-candle light the same length of time.

There is good reason why quality of gas is lost sight of, particularly by the buyer—no ready and accurate means of ascertaining the varying quality of gas exists. The usual apparatus is expensive, and the standard of comparison variable.

Different burners give different values to the same gas, and as the quality varies, the burners should vary. Hence, gas testing is apparently involved in chaos, and some manufacturers seem to think it is their interest to keep it there, because, as they contend, poor gas yields most profit to the manufacturer, and consequently, in their view, is in the long run best for the consumer.

The only well-grounded reason, however, for a dislike of

quality tests is the fear that they will not be carried out; and, above all, the real difficulty of maintaining at all times a uniform standard at the consumer's burner—a difficulty that can hardly be exaggerated.

With coal alone, and even with cannel added, the fluctuations are really great and uncontrollable. The quality varies with the material, the manufacture, the period of storage, the temperature and pressure of air. How to meet all these difficulties is, indeed, a troublesome problem, for certainly, the temperature and pressure of the air are things not controllable. And, if all these difficulties can be made to disappear, the inability of the consumer to ascertain quality puts an apparent and to basing a price thereon. It is surely a poor trade, where only one party can know of a certainty what he is doing. Therefore, any quality basis involves, in reason, the position that the buyer shall be able to ascertain it rightly.

Neither can the price be varied from day to day to suit the quality, as can be done in the sale of other articles. The manufacturer, in this respect, seems to be in an unfortunate position,

Legislation has taken hold of the difficulty, and with about the success we might anticipate. The manufacturer has been discommoded, without any benefit to the consumer. In fact, it is the old story—legislation steps in to adjust differences between buyer and seller, and levies tribute on both, for the benefit of lawyers and supernumeraries.

It is true, gas manufacture in this country has had comparative immunity from the attacks of law makers—not because there is less reason or excuse for interference, however. When gas is sold upon a correct basis which shall embrace quality as one of the factors of value as well as quantity, and when an ordinarily intelligent consumer can be provided a means for ascertaining both quantity and quality to his satisfaction, without having to rely on the certificates of inspectors, then, in fact, the business will have a right to be independent of the interference of special laws, and a just public sentiment will not requite nor even countenance them.

Having mentioned many of the difficulties in the way of establishing a quality basis for prices—made it appear, perhaps, quite impossible—I propose to put forward a plan which, in the present state of the science of gas manufacture, I believe, will meet and overcome all difficulties. I hope it will receive the severest criticism, that not only objections founded on reason will be urged, but the still greater array founded on prejudice, on conservatism, so called.

Before going into the discription, it will be best to clear away in advance some of the apparent difficulties, as well as to state a few further reasons in favor of a quality basis. It will not be necessary to argue that a quality basis alone is favorable to plans for extracting the greatest quantity from any given material, and is, therefore, a premium on a low quality gas, because, in all the range of gas-producing materials the greater cubic measure the yield of gas, the lower the quality and the faster it will consume, either for a given light or with a given pressure. It is true, that with every gas making material, there is a point of yield beyond which the illuminating effect is diminished in a ratio greater than the yield is increased. A quantity basis not only tempts us continually beyond this point, but leads to an excessive degree of ingenuity to deceive ourselves as to its proper location, as, for instance, in the employment of a burner for quality tests, which enhances poor gas and depreciates relatively better qualities of gas. A quality basis, on the contrary, will lead us in the direction of better gas, and in that direction lie the greatest economies. If that is not a true proposition, poor gas in England and Scotland would be selling as cheaply, light considered, as rich gas, which is not the case, and never has been.

It is an undeniable fact that the higher the quality of gas, the more advantageously it burns in such burners, as consumers for other reasons than economy of light are prone to use I speak of high pressure batwing or fishtail burners, as against lower pressure argand burners or checked batwing and fishtails.

The reasons for this preference are plain enough. An argand burner has the drawback of a chimney to clean, and be-

sides will not stand the slightest current of air, particularly if the burner is economical of gas. Flat flame burners of low pressure, though economical of poor gas, compared with high pressure on same, are vacillating, flickering, and prone to smoke. Flat flame burners at high pressure, on the contrary, give a fixed flame, and are little liable to smoke. Low pressure burners have been the sole stock in trade of vendors for years, and yet comparatively few remain in use, notwithstanding their comparative economy with poor gas.

In regard to the difficulties of testing gas, agreeing upon methods, standards of illuminating power, burners, etc., the troubles all lie in giving a proper illuminating value to different kinds of fluctuating qualities of gas. I do not believe it can be questioned that it is in the power of almost any one to ascertain, with the simplest of apparatus and instruction, whether two differant gases are of the same illuminating quality. No question of standard or burners need necessarily intervene. The old durability test, applied with proper apparatus and a little care, will do the business completely. Take, for instance, one of Sugg's "D" argand burners, and, adjusting it to an accurate meter and governor, turn on the gas to a given height of flame (say 3 inches, as Sugg advises), and note for a given time the rate of gas consumption. This experiment often repeated, each time turning down and readjusting the burners, will demonstrate the accuracy with which such a simple matter as the height of flame can be used to show uniformity of consumption. Dilute the gas employed in this experiment with the smallest percentage of a gas giving no light, and the consumption in a given time for a 3-inch flame will change—more gas will be required. Again, take a number of single jets, turn them to a uniform height, and note the amount of gas consumed in a given time. The gas remaining the same, the rate of gas consumption will be surprisingly uniform. A change in the quality of the gas, even to the slightest extent, will show in the consumption, the height of flame being maintained.

As the gas grows richer, the consumption is less, and *vice versa*. Sugg's illuminating power meter is based upon these

facts, but Sugg has gone further, and made a scale showing the quality corresponding to different rates of consumption in equal times.

We might anticipate difficulty in adapting one scale to different gases, and, indeed, there is, unless the difference is provided for by an alteration in the height of flame. Sugg's scale, however, corresponds very closely with results obtained by the use of his Argand burners. For my purpose, I wish only to substantiate that equal heights of flame in Sugg's Argands, and in jets, correspond to equal consumption of gas when the gas is uniformly luminous, and *vice versa*, that equal heights and unequal consumption indicate difference of luminosity.

The difficulties of manufacturing a uniform standard have been mentioned, and appear to be quite insurmountable, if great uniformity is needed. Suppose, however, a gasholder filled with gas below a certain standard, another with gas above the standard, it seems not at all impossible to add of the rich to the poor until the standard is obtained. I am aware that even in the larger works at times during the manufacture there are fluctuations, and it would be difficult, if not impossible, to gauge the admission of a rich gas, even of uniform quality, to produce a uniform result. But to a holder containing poor gas, a uniformly rich gas can be added until a certain standard is obtained.

Having cleared away some of the difficulties, I will now describe my plan of making a uniform gas and selling it on an illuminating basis. There is nothing startlingly new in it; if there was, I should not propose it with much confidence. In fact, it is based essentially upon the well known, the tried and approved.

Having determined upon the kind of gas to be made, I proceed as follows, and for the greater clearness of illustration, I will carry out a supposed case. I have made a number of tests of the Municipal gas in New York, and will take that as a basis to serve for illustration.

I first obtain a 14-candle flame in one of Sugg's new Argands, preferably his "C" burner. Sugg gives in a table the height of flame required in his "C" burner to afford a 14-candle

light, but as his statement is based upon coal gas, it does not quite hold good with Municipal; hence it will be necessary to make a series of tests to ascertain with accuracy the exact height of flame necessary to give a 14-candle light with the gas in question. It is not necessary to note the exact consumption of gas required to maintain the flame, except as a matter of easy control; in fact, a meter on the burner can be dispensed with.

Having obtained a 14-candle flame, I place it at a convenient distance from a photometric screen, and at an equal distance, but upon the opposite side of the screen, is placed an ordinary burner of the excavated batwing variety, with the flat of the flame turned at an angle of 45 degrees, with the line between the two lights. Gas is turned on to the ordinary burner until an equal light is obtained upon the screen. In regard to the flat flame burner, it should be chosen of such size as to afford approximately a 14-candle flame, with a pressure of 4 to 5-tenths at the point of ignition. In the case of Municipal gas, it should be a 4-foot excavated lava-tip batwing. It would be found to consume 2 6-10ths cubic feet of gas to afford a 14-candle flame. As this point is a matter of importance, which has to be ascertained once for all, a series of tests must be taken. The batwing should be turned off, and again on, to a point of equal light many times; at each operation ascertaining by an accurate meter the hourly rate of consumption. A mean hourly rate having been ascertained, the third step is to find the height of flame in a suitable Sugg Argand which a rate of consumption equal to that of the 14-candle consumer's burner will give. It will be best for this purpose to use an Argand a size smaller than the one previously employed to get a 14-candle flame—say burner "B" of Sugg's series. As a check, it will be well to supply a cluster of simple jets, say 3 to 5 in number, with an amount of gas equal to that required for the 14-candle flame burner, and to note the height of the jets, the height of all being equalized. The two Argand burners are to be marked with a ring on the chimney of each—that on the larger, "C," indicating the height of flame required to give a 14-candle light; the smaller one, "B," the

height of flame afforded by a rate of consumption equal to that of the consumer's batwing when giving a 14-candle jet.

The burner "B" thus marked I call the "consumer's test burner." Attached to a governor, it can be used by the consumer to test the registration of his gas meter, on a plan which will be presently described.

The manufacture of a unifomr gas by the Municipal method is by no means a difficult task.

We have now an argand burner "C" marked with the height of flame required to make a standard light. We have also a rate of consumption by the meter, corresponding to a given height of flame. In the manufacture we have to see to it that for the given height of flame a uniform consumption rate is maintained from day to day. I believe the simplest way to do this is on a plan first introduced in Waco, Texas, last year. The argand burner "B" is adapted to an accurate meter and governor, and the standard gas is turned on to a convenient height of flame short of smoking or tailing. The consumption rate having been ascertained, the motion of the gas hand is geared up or down, as the case may be, so that the gas hand of the experimental meter shall revolve in exactly one minute. The standard quality of gas is then turned on until the hands of the minute clock and the gas hand revolve exactly together for a number of minutes. The height of flame is then marked on the chimney.

For convenience, it will be best to have the clock hand and meter hand run concentric, as in Mr. Sugg's experimental meter. It is plain, then, that with the height of flame as marked, the hands of this meter and clock will run together, with gas of the proper standard; as the standard varies, the gas hand will gain or lose on the clock.

My plan is to alter the richness of the gas from time to time, by altering the feed of naphtha, so as to keep the hands revolving together. To do this most effectually in a large works, the test meter should be located to take the passing gas as near the retorts as possible, and to that end should have a small purifying apparatus connected with it. The changes will thus be more quickly noticeable. The difference in relative purifi-

cation may cause the test to vary slightly from the standard, and to note this difference if desired, a duplicate may be made to run on the gas coming from the large meter.

There is no difficulty in adjusting the feed of naphtha to produce a given richness of gas; in fact, the feed can be far more delicately regulated, than we can obtain indications whereby to regulate it.

Being in a position to produce a practically uniform gas, there is really no great reason why it cannot be sold upon a quality basis. I will shortly describe the means I have found most effectual to accomplish it. The price of gas light is stated at a definite price per hour for a 14-candle light. If it is desired to make the new standard easily comparable with coal gas prices, it is only necessary to remember that a 14-candle flame requires fully a consumption rate of 5 cubic feet per hour, in a moderately checked burner. This burner will give a flame somewhat lacking in steadiness, and will opproximate the point of smoking; but an economical burner for coal gas, and yet one desirable in other respects, is very hard to find. A compromise between economy and steadiness of flame will have to be made.

The following table will serve to show the cost per hour for a 14-candle flame corresponding to various prices for good coal gas:

Coal gas,	at	$1.00	per M.	affords	a light	of 14 candles,	for	½	cent per hour.
"	"	1.50	"	"	"	"	"	¾	" "
"	"	2.00	"	"	"	"	"	1	" "
"	"	2.50	"	"	"	"	"	1¼	" "
"	"	3.00	"	"	"	"	"	1½	" "
"	"	3.50	"	"	"	"	"	1¾	" "
"	"	4.00	"	"	"	"	"	2	" "
"	"	4.50	"	"	"	"	"	2¼	" "
"	"	5.00	"	"	"	"	"	2½	" "

And so on, adding one-quarter of one cent per hour for each 50 cents per thousand cubic feet.

The above comparison is based upon really good coal gas, such as made at Boston and a few other points I could name. I believe it is based upon a quality above the average.

In the case which I have been following, it is evident that

the meters would have to be so arranged as to register 1 cent per hour for each 2 6-10 cubic feet of gas, to put the price equal to coal gas at $2 per thousand. This would be very easy to do. The above ratio is based upon Municipal gas, as actually found; a slight increase of naphtha would bring the rate of consumption to 2½ cubic feet, which would be a better ratio. It is obvious that the meter registration can be arranged in divers ways to accomplish my purpose. For instance, it might be made to register hours consumption of a 14-candle power. The dial in this case would be in standard 14 candle hours.

Each hour registered would indicate a light of 14 candles for one hour where the consumer's standard burner is used. If a larger burner is used, a slightly greater proportional light would be obtained; if smaller, slightly less. Rich gases, however, give but slight variations in the ratio of light to gas consumed, for varying consumption.

If a "standard hour meter" is used, the hours indicated have to be multiplied by the price, just the same as with the cubic foot meter, with this difference—that a standard hour light is a definite amount. Again, the meter may be made to register "candle feet." I borrow this term from Mr. Farmer, only giving an altered meaning to it.

Five candle feet give an hour's 14-candle light. For a 14-candle gas, 5 candle feet and 5 cubic feet would measure the same; for any other quality they would differ in cubic measure, but be the same in light giving power. One thousand candle feet would always equal 1,000 cubic feet of coal gas in light giving properties. Between candle feet and cubic feet would be this difference: 5 cubic feet *may* give a light of 14 candles for an hour; 5 candle feet *must* do it. The candle feet bills would be made out as usual—say "1,000 candle feet, at $2 per 1,000," means that the consumer has had 200 hours' consumption of a 14-candle light.

I have spoken of this programme as a proposed plan. It has, however, been carried out for a number of years, and is working more or less successfully in about forty towns. The methods have been perfected from time to time. The last im-

provement has been to put the consumer in possession of a certain and accurate test, as above described.* To bring the consumer into friendly understanding with the company, and make him their advocate, and the advocate of the much-abused gas meter, is indeed a matter of congratulation, if it can be done. The method of doing that is, in my opinion, to furnish him a means of satisfying himself of the general accuracy of meters, and the uniformity of light. Very few consumers are aware of the present accuracy of meter measurement, because they have no independent means of establishing it.

Now come the objections to the system. The trial already had, has developed all the objections likely to arise on the part of the consumer, and in a far stronger light than they can now be viewed. When the system was first introduced it was more difficult to manufacture a uniform standard, for though no new principles of testing have been applied, old ones have been modified and perfected to best suit the emergency. The jet photometer did not answer to rate naphtha gas. We had to go back to the principle of the old duration test of Dr. Fyfe; but instead of using his single jet, it is better to use an assemblage or one of Sugg's burners. Then we had no means at the start to make the consumer his own judge of quality. He had to rely on comparatively crude tests, but, notwithstanding, I heard of but few complaints from the consumer. He was generally satisfied with the statement that such and such a burner gave a fourteen candle light. This was no doubt owing to the fact that great pains were taken to keep up to or above the standard promise.

The first town in which I set the meters, Sunbury, Pa., gave to the official test 39 hours' light for 35 cents. The rate was to have been 1 cent per hour a 14-candle light.

I attach hereto a copy of the test made at Waco, Texas, during July and August, 1879, showing the degree of uniformity that can be expected. After each filling of the holder at Waco, a test meter, provided with a burner such as described, is set

* The meter was patented, but no extra charge was made for it on that score. It is my intention to patent the above, in connection with the standard light for proving.

in motion, the clock hand and gas hand together. At the end of ten minutes the fraction of a cubic foot of gas consumed is entered in the accounts. From that is deduced the time required to burn one cubic foot of gas, giving a continuous 14-candle flame. The report shows, during July, a mean of 39.01 minutes' duration for 1 cubic foot, highest 40 minutes; lowest, 38.6 minutes; highest above the mean, 2½ per cent.; lowest below the mean, 1 per cent. August shows: highest, 40 minutes; lowest, 38.6; mean, 39.24.—thus differing but 57-100ths of 1 per cent only from the previous month. When it is remembered that one cubic foot supplied in an argand burner a light of 14 candles for a period of 39.24 minutes, the richness of the gas seems quite extraordinary.

So far as I am aware, no objection has been made public against the selling of gas upon an illuminating basis, unless, indeed, the report of the committee from Waterbury, Conn., published in the *American Gas Light Journal*, can be taken as a critiscism. In order to answer it, I will first state that a committee from Waterybury, had been investigating a new process of gas making, in operation at Rhinebeck, N. Y. They there found the bills were registered by a dollar and cent meter. Comparing a number of the bills so registered with statements of consumers as to hours burning, number of burners, etc. the committee found great discrepancies in registration.

Though a similar method of comparison, if carried out elsewhere, would undoubtedly show great discrepancies, from the fact that few gas consumers can accurately state the number of burners, hours lighted, size of burner, or mean pressure of gas; yet from the report it is plainly apparent that the consumers at Rhinebeck had no means provided for them to ascertain the general accuracy of their meters. In fact, if the committee is correct, the Rhinebeck Gas Company sets a dollar and cent meter, registering at some unknown sum per cubic foot, instead of setting a cubic foot meter to register upon an unknown quality of gas; hence Rhinebeck is virtually supplied upon the cubic foot no quality stipulation basis.

I see no difference between the dollar and cent basis at Rhinebeck and the ordinary cubic foot basis elsewhere. They

both deal in unknown values. The price of gas, to correspond with its value, must be based upon quantity and quality combined. In the present state of the science of gas making, we have a choice of materials which range from 1 to 5 in illuminating value for a given bulk. Hence quality has become, if possible, a greater factor than quantity. Yet prices are based upon quantity alone. To apply this to the Rhinebeck case, had the dollar and cent meter been constructed to register the gas as manufactured there, in exact correspondence with stipulated light, there would have been no good cause of complaint. On the bill as presented to the consumer should have been some such words as follows: "This bill is registered by meter in dollars and cents, at the rate of 1 cent per hour for a 14-candle light" And if, in addition to that stipulation, the consumers were furnished with easy and accurate means for ascertaining that light, and comparing it with the registration of the meter, it seems to me that not one reasonable consumer in Rhinebeck would have complained of the system.

At Coney Island the dollar and cent meter was used by the Kings County Gas Light Company, and some dissatisfaction was expressed by one of the largest consumers. As in the case at Rhinebeck, there was no clear understanding at Coney Island about price. The bills were made out at $2.50 per thousand, just the same as if a cubic foot meter were used. I believe the meters registered in dollars and cents on a basis of $12.50 per thousand. This price was assumed to be equal to coal gas at $2.50.

The registration of meters in dollars and cents was divided by 2.50, and the bill made out for a number of cubic feet to correspond to that. This plan was all wrong. The price should have been stated at so much per hour for a 14-candle light. In the case of Coney Island it would have been 1¼ cents. Pains should have been taken to show consumers the accuracy of the registration as compared with a given number of hours consumption of a standard burner.

The managers at Coney Island appeared to have an entire misapprehension as to the use of the dollar and cent meter. They seemed to think it necessary simply to get meters of a

given rate, and set them without any understanding with the consumer, or without furnishing him any means of satisfying himself. Nor was there any apparatus, nor test, whereby to maintain an unvarying and standard quality of gas. The quality was judged simply by a flat flame test burner. Now, my experience is, that rich gas can undergo a great change in quality, and yet make a good flame.

This arises from the fact that as the gas lowers in quality, more of it is burned, thus frequently improving the *appearance* of a rich gas flame, while the quality is far from the standard. I found the gas by test at Coney Island to be at one time 21 per cent below the standard, but this was owing to the fact that the apparatus was not adapted to making a gas of 70-candle standard sufficiently clear from smoke. This was afterward remedied, in great part.

In conclusion, I wish to submit the following propositions for discussion, believing that I can substantiate my views of the advisability of manufacturing and selling gas strictly upon an illuminating basis:

1. By a proper use of naphtha or mineral oils gas can be made either pure or mixed, of great uniformity, in regard to illuminating power.

2. To attain this uniformity, a modification of the durability test is most useful, and without a *continuous* test, somewhat as described above, no great uniformity ought to be anticipated.

3. Owing to the great range in quality of gas, as manufactured at present, it will be conducive to the interests of the manufacturer, as well as the consumer, to sell gas upon an illuminating basis.

MR. FORSTALL—I move that a vote of thanks be tendered Mr. Edgerton for that paper. [Carried.]

Discussion on Mr. Edgerton's Paper.

MR. FORSTALL—The question opened by Mr. Edgerton is a very important one. It is a source of regret that he is not

here in person to answer objections that naturally arise. There is no doubt that, theoretically, he is right. We should sell our gas according to its quality, just as any other manufacturer sells his goods. If I sell 30-candle gas by the thousand cubic feet, and sell 15-candle gas in the same way, at the same price, it seems absurd on the face of it. The difficulty in applying the theory to practice in this case is simply a difficulty of detail. If we were starting gas works in a new country that had never had anything to do with meters or cubic feet, it is very likely that our first idea would be to sell our gas according to its illuminating power. But a great many companies in this country are bound by statute to sell gas by cubic feet. That is the case in New Orleans. We are entitled to receive so much per thousand cubic feet. We can afford to give 15-candle gas, we will suppose, for the price we are entitled to charge. If we should make thirty-candle gas, we cannot charge any more. The meters are rated at so many thousand cubic feet. These considerations would, at the outset, prevent Mr. Edgerton's plan from being carried out in New Orleans.

Mr. Somerville—I could not get the exact drift of the paper in some particulars, but I thought, in listening to it, that he advocated a meter that would satisfy the consumer. If that is so, I think it is certainly a very desirable thing.

Mr. Helme—I remember that, some years ago, Mr. Edgerton patented a dollar and cent meter that he refers to. He had a patent for a meter that, instead of having cubic feet on the dial, had dollars and cents, and a good many of them were introduced. But some consumers, thinking their bills were no less than they were when they used a cubic foot meter, got to questioning the thing a little too closely. They were like the fellow in Washington who had a double register meter at the time when they were being introduced there. He thought his bills were quite as high, if not a little higher, than they were before under the old system, although it cost a good deal less per thousand. He took the meter out one morning and tested it, and for every thousand feet they charged for, the meter only registered five hundred feet. He put it back again, and,

after a while, the bill came around and he would not pay it. They finally threatened to sue. He said to them, "I am ready for that. I have been figuring it out, and I find that you owe me so much money. Your meter only registers five hundred feet for every thousand feet you charge for; and if you do not pay me I will sue you."

That was an end to the double register in that town. Mr. Edgerton's dollar and cent meter is constructed upon a theory which may, perhaps, be all right if it can be carried out practically. If he makes a uniformly high quality of gas, and puts on small burners, he certainly gets a good light for a small amount of gas. But the difficulty comes in there, as it does in most places, the small burners close up, and the gas fitters are always ready to put on new burners whenever you want them to. The result is that people become dissatisfied in places where they have gone on the basis that a high quality of gas should be sold for a correspondingly increased price. Although the meters were rated right, yet when they came to figure upon it in some places, it was found that they varied a good deal. In some cases they registered 10,000, in others 7,500, and so on. I will not vouch for the figures exactly, but I heard of two meters where one of them registered 10,000 and the other 15,000. People began to think that there was a good deal of uncertainty on the part of gas companies, and they will think they have been cheated unless you have printed on the back of your bills full instructions as to how the meters should be read, and how they can themselves tell whether they are using a large or a small amount of gas. But even if you educate them up to that point, they will forget it before the next bill comes round. The result is that I do not see any better way than to keep on with the cubic feet meter.

Mr. Starr—I presume it might be well to have a good meter to register the quality of gas; but I cannot see why a dollar and cent meter should be any better than any other, because you have got to use the feet measure. It is to the interest of all gas companies to make good gas. That will give more satisfaction than any meter that registers dollars and cents or otherwise. I think the difficulty would be to find

something that will give the test quality of the gas in the meter.

PLACE OF NEXT ANNUAL MEETING.

MR. NEAL—I will state that the committee appointed to determine upon a place for the next meeting unanimously recommend that the next annual meeting of the Association be held in Boston.

On motion of the Secretary, the recommendation of the committee was adopted, and the committee discharged with thanks.

The Association then took a recess until 2 o'clock P. M.

AFTERNOON SESSION.—OCT. 14TH.

The Association met at 2 P. M., pursuant to adjournment.

THE PRESIDENT—Having decided to hold our next annua meeting at Boston, it becomes necessary to appoint a Committee of Arrangements to prepare for it. The following gentlemen will constitute the Committee:

Malcom S. Greenough, of Boston, Mass.; George B. Neal, of Boston, Mass.; A. B. Slater, of Providence, R. I.; O. E. Cushing, of Lowell, Mass.; J. H. Rollins, of Worcester, Mass.; and the Secretary.

Mr. Pearson, of Toronto, Canada, then read a paper entitled

THE WORKING OF THE LOWE PROCESS AT TORONTO.

This paper is presented in compliance with a request conveyed in a resolution passed by this Association at its last meeting. Had I merely consulted my own inclinations, I should have respecfully declined this request; but, believing that it is due to the Association that they should have fuller and more complete information upon the subject than I was able to present in my last paper, and that the interests of gas making would be promoted thereby, I have waved my personal feelings.

I wish it to be understood that I do not appear as an advocate of the Lowe process, but that it is simply my intention to pre-

sent facts regarding it of which I am cognizant, and leave it to the members of the Association to draw their own conclusions therefrom; and in doing this I shall endeavor as frankly to mention what I believe to be its disadvantages as well as its advantages, but it is certainly a fact that I am still as well satfied of the superiority of the process, as a whole, over the old process as I was last year.

It will not be necessary for me to give a description of the process, or the method of working it, as I did so in my last paper, and most of the members of the Association are doubtless well acquainted with it, and those who are not can easily obtain the information elsewhere. I shall therefore, without further introduction, enter upon the discussion of those points which I believe will be of interest to the meeting as a whole.

Gas by the Lowe process was first made in Toronto on February 9, 1879, with two sets of apparatus. Between then and September 30, 1879 (up to which time I had reported), 26,641,000 cubic feet had been manufactured. Two more sets went into operation on December 19; two more on January 3, and in August last a seventh set was completed.

Up to February 17, the process was worked in conjunction with coal gas works; since that time gas has been made by the Lowe process alone. In referring to the general working of the process, and in giving items of wear and tear, I shall go back to the time of its introduction; but I shall give the items of the manufacturing statement from the date the gas was made by the process alone up to September last, the end of our financial year. This statement I now give below:

Statement of Gas Manufactured by the Lowe Process at the Works of the Consumers' Gas Company, Toronto, from Feb. 17 *to Sept.* 30, 1880.

Number of charges	14,865
Average production per charge	4,690
Total production, M cubic feet	69,729
Average material used per M feet—	
In generators:	
Crude petroleum, gallons	4.29
Anthracite coal, pounds	59

In boilers :	
Anthraçite coal, pounds....	4
Bituminous coal, pounds....	7
Average gas purified per bushel lime, M feet	9,709
Purification—	
Material average cost per M feet, cents........	2.16
Labor, average cost per M feet, cents..	1.48
Superintendence and labor—	
Gas making, including salary of superintendent and wages of 2 formen, stokers, engineers, and coal wheelers ; cost per M feet, cents	7.65

The largest production per diem of 12 hours from 4 sets was 270,000 cubic feet ; 6 sets, 362,000 cubic feet. The largest production per diem of 24 hours from 6 sets was 681,000 cubic feet.

Between April 18 and September 21 all the gas was made in the daytime, except on special occasions, and none was made on 20 Sundays.

Three stokers are sufficient to work 4 sets, and on emergency 5; and 4 stokers can work 6 sets, and on an emergency 7, each capable of producing 100,000 cubic feet in 24 hours.

The men at the purifiers are also employed at other work, though their whole time is charged to purification.

The cost per thousand for superintendence and labor will, of course, be considerably lower during the winter months, when a larger quantity of gas is made (with us, about 75 per cent more in six months, commencing October 1, than in the six preceding months), and only the same superintendence and same number of engineers and men at purifiers being required.

Steamboat size coal has been found the best to use, as allowing sufficient space for the steam to pass through during the process of gas-making.

The Canadian crude petroleum used is much inferior and heavier than American, the gravity being 31° and 32°, and produces a large quantity of tar—American crude being about 45°, and comparatively free from tar. Gas oil of 35° gravity, costing about the same as crude, is now being used with more satisfactory results.

Condensation in Holders and Distribution.

This is a point that has considerable effect upon the unaccounted-for gas account and illuminating power, and one that came up in the discussion on my paper last year. I was not able to give definite information regarding it, not having then had the opportunity of making any satisfactory test. Since then I have given the matter a good deal of attention, and I am satisfied that but very little condensation takes place after the gas leaves the works—in fact, almost none.

Of this I have obtained proof in various ways. I put five feet of the gas into a meter prover. Seven days after, with the thermometer and barometer the same as at first, no loss whatever had taken place. Three days after, at same temperature, there was a loss of 2 per cent.

In another experiment no loss was shown until the sixth day, when a diminution of 1 per cent took place.

On making a third test, no shrinkage took place until the fifth day, and on the eleventh day but 2 per cent loss was shown.

During the time of the experiments the temperature ranged from 52° to 67° F.

The illuminating power of the gas was taken at the commencement and close of each test, with a Sugg's illuminating power-meter, and no perceptible difference was shown.

The gas was kept in a holder at the works for four days, without any apparent loss in quantity or candle power, the candle power being taken with a jet photometer. This is not as satisfactory a test as to loss in quantity as the former ones, as the temperature at its commencement and close was not carefully noted; but it was more satisfactory as showing that, notwithstanding its exposure to a low temperature, the gas retained its illuminating power—the gas being tested in March in a holder in the open air, and the difference between the highest and lowest temperature being considerable.

In February and March last a burner was supplied with gas passed through a half-inch pipe a distance of 20′, with a fall to catch condensation, exposed to the temperature during three weeks of cold weather, and, notwithstanding the thermometer registered as low as 6° F., the light was unaffected, and no condensation whatever was found.

Statement Showing Illuminating Power and Purity of Gas Supplied by the Consumers' Gas Company for the Year ending Sept. 30, 1880. Made by Government Inspector.

1879–80.	Illuminating Power.					Sulphur per 100 Cubic Feet.					Ammonia per 100 Cubic Feet.					Sulphurated Hydrogen—Times Present.
	Highest Candles.	Lowest Candles.	Average Candles.	Standard Candles.	Number Tests	Highest Grains.	Lowest Grains.	Average Grains	Standard Grains.	Number Tests.	Highest Grains.	Lowest Grains.	Average Grains.	Standard Grains.	Number Tests.	
October	15.05	13.18	14.25	12	4	15.05	8.36	11.89	20	4	15.35	1.77	9.59	2	4	0
November	15.35	13.89	14.49	12	8	13.82	9.69	10.91	20	4	17.73	3.02	9.08	2	4	1
December	16.33	13.93	14.91	12	9	14.32	8.85	11.74	20	4	2.50	0.50	1.49	2	4	1
January	17.65	14.62	16.09	12	9	12.50	8.30	10.53	20	4	2.26	1.50	1.82	2	4	1
February	16.54	14.74	15.90	12	12	12.19	7.51	9.60	20	4	1.50	1.01	1.26	2	4	0
March	16,46	14.52	15.71	12	14	10.50	9.21	10.02	20	4	1.75	0.25	1.06	2	4	0
April	16.98	15.12	16.06	12	8	17.49	11.28	14.14	20	4	0.76	0.25	0.44	2	4	0
May	16.84	14.67	15.76	12	8	13.10	7.61	10.37	20	4	1.52	1.00	1.26	2	4	0
June	16.81	15.16	16.11	12	8	13.14	9.41	11.15	20	4	1.81	1.00	1.47	2	4	0
July	16.81	15.23	16.17	12	8	12.26	9.25	10.35	20	4	1.55	1.00	1.27	2	4	0
August	16.28	15.55	15.89	12	7	9.24	6.89	8.06	20	4	1.54	0.77	1.08	2	4	0
September	16.43	14.23	15.72	12	7	12.50	8.26	10.11	20	4	1.25	0.50	0.87	2	4	0

Mixed gas supplied until February 17; after that, all Lowe gas. Tests made with a Bunson bar photometer. Burner used, Sugg's 24-holed London Argand No. 1. Place of testing, about three-quarters of a mile from the works.

The following comparative statement of the unaccounted-for gas account for a number of quarters in this connection may not be uninteresting :

Statement of Unaccounted-for Gas.

Quarter Ending.	Gas Manufactured.	Loss.				Miles Pipe Laid.
		Quantity.	Per Cent.	Per Mile Pipe Laid.		
				Per Quarter.	Per Diem.	
September 30, 1878	All coal.	4,430,100	19.75	52,118	572	85.00
Do. 1879	44¼ per ct. Lowe.	4,615,000	18.25	50,614	556	91.18
Do. 1880	All Lowe.	3,610,200	13.70	37,039	407	97.47
December 31, 1878	All coal.	6,956,200	15.75	80,223	872	86.71
Do. 1879	31 per ct. Lowe.	5,960,500	12¾	64,291	656	92.71
March 31, 1879....	11¼ per ct. Lowe.	6,250,400	15.50	72,084	792	86.71
Do. 1880....	78¾ per ct. Lowe.	3,327,700	7.¾	35,893	394	92.71
June 30, 1879......	47 per ct. Lowe.	4,306,900	17.25	49,464	543	87.07
Do. 1880......	All Lowe.	1,864,200	7.34	19,916	218	93.60

Between August 1 and October 16, 1879, about 1,600 yards of 20-inch pipe were substituted for smaller sizes, as a trunk main, and between the middle of May and the middle of July, 1880, it was extended 2,200 yards further.

The day pressure was considerably increased in July last, in consequence of an increased demand for gas in the daytime. The night pressure on the mains supplying the principal portion of the gas consumed was increased about one-seventh in December last, but notwithstanding this, however, the supply was defective.

In the middle of July last, when all the connections were made to the trunk main referred to, the pressure was reduced to what it was before. This, however, gave a very much higher pressure in certain localities where there had been a deficiency before, even with the higher pressure. This and the increase in the day pressure referred to, will, at all events, partially account for the increase in the unacconnted-for gas account in the last September quarter, as compared with that of June last.

No leaks of any consequence were found in the pipes replaced by the 20-inch main referred to, nor elsewhere during the last two years.

The station meters were tested and found correct. The workmen all say that there is not a quarter of the condensation in the drips that there was formerly.

I do not claim that the whole of the reduction shown recently has resulted from the cause referred to, but I cannot but conclude that it is mainly to be attributed to it.

Specific Gravity.

The specific gravity obtained by the effusion method, with the apparatus designed by Mr. W. W. Goodwin, averaged about .560. I did not obtain that of the coal gas, but assumed it to be .443—the approximate gravity of 15-candle gas. Theoretically, about one-eighth more pressure would be required, and in practical working that addition to the pressure at the works gave the same pressure on the burners in various localities, as there was when coal gas was supplied. I also verify this by testing both gases with a meter and burner prover.

Heating Power.

Not having any analysis of the gas from which to obtain this theoretically, I tested both gases in a somewhat crude manner, with the results shown in the following table.

The water was put in a covered tin vessel, and the thermometer inserted through a hole in the cover. The burner used was a common batwing, and the vessel was in all cases suspended at the same distance above the flame. The time was carefully noted, and the gas was passed each time at the same pressure from a meter prover through a burner tester. The temperature of the room in each test did not vary more than two degrees.

Date of Test.	Minutes Taken to Raise Tem. from 70° to 120°		Cubic Feet of Gas Consumed.		Size Burner Used.
	Coal.	Lowe.	Coal.	Lowe.	
Jan. 23, 1880.	16.00	15.15	1.20	1.14	4½ feet.
" 24, 1880.	16.45	....	1.25	....	4½ feet.
" 24, 1880.	10.30	....	1.22	....	7 feet.
" 26, 1880.	....	15.00	....	1.12	4½ feet.
" 27, 1880.	16.30	....	1.23	....	4½ feet.
Oct. 9, 1880.	....	16.14	....	1.21	4½ feet.
" 9, 1880.	....	16.14	....	1.21	4½ feet.

Quantity of water used, 2.75 lbs.

I cannot account for the different results obtained from the Lowe gas on October 9, except that the composition of the gas must have varied at different times. The results of the tests are only claimed to be approximately correct.

Residuals.

The only available residual is the tar, and this contains a large quantity of water, some of which it retains mechanically

even after boiling. Passing it through a sieve has had the effect of removing a large proportion of the water, and we have hopes of being able entirely to remove it eventually.

The following analyses of the tar were obtained from Dr. W. H. Pike, Professor of Chemistry, University College, Toronto:

Per 100 parts by weight—

Water........	28	Corresponding	to	Water........	0
Light oil	3	"	"	Light oil......	4
Naphthaline ..	18	"	"	Naphthaline...	24.5
Anthracine oils	13	"	"	Anthracine oils	18.2
Pitch	38	"	"	Pitch.	53.3
	100				100

Owing to the large quantity of water that runs away with the tar, it is difficult to say accurately how much is made. I should judge it to be between 15 and 20 per cent of the oil used.

Purification Requirements.

We have found lime to be the only effective purifying agent we have tried. Oxide of iron has been tried, but in a few days it is converted into a thick paste, owing to the oily nature of the gas, and fails to take up the impurities, and it cannot afterwards be renewed. Lime thoroughly slaked and allowed to remain so for a couple of days before using, produces much better results than lime slaked and used immediately, about 40 per cent more gas being purified to the bushel. Owing to the gas being made with great rapidity, larger purifiers, with deeper cups, are required than for coal gas, each generator producing about 5,000 cubic feet per run of 20 minutes. Passing the gas into a small holder before purification would, no doubt, remedy the difficulty, as it could be passed regularly, and at such pressure as might be found best. At present we aim at commencing to run each set a few minutes after the other in order to accomplish this.

Obstructions.

The only difficulties of any importance that have been experienced have arisen from naphthaline. But little trouble was experienced or expected from this until about a month since, just as the cool weather commenced, or provision would have been made to obviate it by conveying the gas for some distance over tar as is done in coal gas works. The difficulty, however, is not as great as that we have experienced from the same cause with coal gas, and is confined to the pipes in the works, and a number of services where they enter the houses.

There have been no obstructions whatever in the mains. Some which were taken up last week within a short distance from the works were almost as clean as when they were put down years ago.

Trouble has also arisen from the closing up of the lava tip burners with a substance as hard as the burner itself, which forms on the side of the orifice, and increases until the burner is closed up, and which cannot be removed. Oxidation and the deposition of carbon have been suggested. The difficulty was not altogether unexpected, as we were informed that elsewhere lava tip burners would not answer.

The most peculiar and apparently unaccountable feature is that these stoppages are almost entirely confined to burners in houses at the extreme limits of the mains, and are not caused by any impurities carried forward in the gas. The evil does not exist to any extent, and the substitution of brass burners remedies it, as they are never effected in a similar manner.

This trouble is not confined to Lowe gas, as I have been informed by the manager of a coal gas works that some of the burners of his company were effected in a similar way.

Wear and Tear.

Since the erection of two sets of apparatus in February, 1879, $603.87 have been expended in repairs. This expenditure was for re-lining two of the generators, sundry repairs to others, and to the superheaters, and taking down and re-building and altering brick work for boilers. Part of this expenditure was rendered necessary by some of the blocks in the genera-

tors being unsuitable for the purpose. The gas made by the apparatus during this period was 126,030,000 cubic feet.

Cost of the Apparatus.

As information upon this point was particularly desired by several members at the last meeting of the Association, for their benefit, and that of any others who may desire it, I now furnish it.

The two sets, with generators $10' \, 6'' \times 5'$, and superheaters $15' \times 4'$, with all connections, and a 25-horse power engine and boiler, working gallery $30' \times 36'$, oil storage tank, and two oil distributing tanks, purchased from the patentee cost $8,600. The five sets of similar size with gallery, all valves and distributing tanks, connections and foundations, one 25-horse power engine, two boilers, steam hoist, four oil storage tanks of 42,000 gallons wine measure capacity, etc., cost $20,000.

Conclusion.

Owing to having to wait until a few days ago to obtain information for insertion in this paper, I have had to prepare it at a time in which I am the busiest of the whole year, and much more hastily than I could have desired. It is consequently not as complete as it would otherwise have been. I can only say that it is as full as I could make it under the cir cumstances. I trust, however, notwithstanding the imperfect manner in which I have presented the facts given, respecting the working of the process, the objects which I have in view, and referred to in my introductory remarks, may to some extent be secured.

The reading of the paper was greeted with applause.

MR. FORSTALL—Before the discussion on the paper commences, I beg leave to present the following report of the Committee on Weights and Measures:

CHICAGO, Oct. 14th, 1880.

To the President and Members of the American Gas Light Association:

GENTLEMEN—Your Committee, to whom was referred the matter of a standard for weights and measures to be used ex-

clusively by the members of this Association in comparison of results, beg leave to make the following recommendations :

1. That all statements of gas production be made in cubic feet per pound of coal, specifying the kind and quantity of enriching material used—if it be cannel, in percentage of the total weight, and if naphtha, in gallons per 1,000 cubic feet of total gas production.

2. The U. S. standard bushel of 2150.42 cubic inches, for the measurement of coke and lime. Statements of lime to specify whether slaked or unslaked.

3. The U. S. standard gallon of 231 cubic inches for the measurement of tar, naphtha, oil and ammoniacal liquor.

4. That all statements of illuminating power be accompanied with the description of the burner and photometer used in testing; and we further recommend the general adoption of Sugg's London " D " burner.

Respectfully submitted,

THEOBALD FORSTALL,
A. B. SLATER,
G. S. HOOKEY,

Committee.

MR. BROWN—I would like to ask Mr. Forstall if, in naming a ton, he means a ton of two thousand pounds, or a ton of two thousand two hundred and forty pounds ?

MR. FORSTALL—We have thrown out the ton altogether.

MR. BROWN—It may be necessary to name it in some instances.

MR. FORSTALL—The production is referred to as so much to the pound of coal.

MR. BROWN—In some cases you might want to use a ton.

MR. FORSTALL—We found that in the New England States, and along the Atlantic seaboard, and along the Gulf of Mexico, a ton means twenty-two hundred and forty pounds. In the Middle States and in the West it is two thousand pounds. Any member mentioning a ton can always state whether he means a ton of two thousand or a ton of twenty-two hundred and forty pounds. Any ton we should adopt would only be

the ton of the members of the Association. We thought it better to ignore the ton entirely, and refer to the production as so much per pound of coal, the price of coal always being stated in tons of so many pounds.

MR. WOOD (of Syracuse)—There is still another ton, the retail coal dealer's ton. [Laughter.]

THE SECRETARY—I move that the report of the Committee be adopted. (Carried.)

THE PRESIDENT—We are now ready for any remarks on Mr. Pearson's paper. I hope the members of the Association will not hesitate to express their views.

MR. LITTLEHALES—I am rather disappointed in Mr. Pearson's paper, especially so since we have got no financial results, and the financial question is the one we have got to fall back upon at last. The mere fact of getting so much gas out of so many pounds of coal and oil, etc., is only one side of the question. There may be a great many other things affecting the general financial result. Unfortunately, Mr. Pearson has omitted that entirely, and I think the Association will very much regret that fact.

MR. PEARSON—What do you refer to particularly?

MR. LITTLEHALES—I am simply speaking of the financial advantage or disadvantage to your company with reference to dollars and cents.

You are all aware that when a saint is to be canonized there is one appointed, called the "Devil's Advocate," who is supposed to bring forward all he can against the saint, so that if he goes through the ordeal successfully he shines all the brighter afterwards. So I propose advancing all I know against Mr. Pearson's process, in order that the Association may have the advantage of his refuting it so far as he can. First, I would like Mr. Pearson to tell us his highest and lowest record of the illuminating power. He gave an average of 15.91.

MR. PEARSON—The lowest record is 14.23, and the highest 16.98.

MR. LITTLEHALES—Most of you know that I am a pretty near neighbor of Mr. Pearson, and, consequently, I go around

and take notes occasionally. I have been through his place very frequently. I have been there when the gas has been first rate, and I have seen it when it has been simply abominable. I have seen it when it has probably been twenty candles, and I have seen it when it has not been ten. I do not know that that is an evil inseparable from the system ; but I know that, so far as my observation is concerned, that is a fact. I also know another fact, and that is that the city of Toronto is obtaining a rather unenviable notoriety for its bill of mortality. Within the last few months there have been two or three killed and two or three disabled by the gas there. These accidents have been generally attributed to the ignorance of the Canadian backwood's man in not knowing enough to turn off the gas, but blowing it out. There is a good deal of ignorance, unquestionably, in that section, but I do not think this somewhat extraordinary bill of mortality arose from that. I think it arose where the gas had not been turned off, or possibly turned on again. Several deaths have occurred. That fact Mr. Pearson has not referred to, which is rather unjust to this Association. We want to get at the bottom facts in regard to this process, and if death is likely to ensue from its use, I think one human life is more valuable than twenty Toronto gas companies, or any other gas company, or twenty Lowe processes, or any other process. Human life is too valuable a thing to tamper with, and if there is anything in the process which may endanger life, I think we should investigate the matter to the bottom. There is this fact that several lives have been lost there. There is this further fact, which has come under my observation, that, in one or two instances, people have been disabled. There was one case that I was informed of by a hotel manager in our part of the country where a man was subjected to the influence of this gas, and it was two or three days before he was able to leave his bed. Besides, there have been several other cases that I could mention. These are facts that ought to enter into the consideration of this question. The mere fact of making a few feet of gas extra per pound of coal is a very small matter in comparison with the value of human life. That is a point that I hope Mr. Pearson will refer to.

Then there is a difference in the illuminating power of the gas, as I have explained before. I have seen it sometimes when it has been very good, and I have seen it at other times when it has been simply miserable. I have inquired among the people of Toronto, hotel keepers and private consumers, and I have heard very unfavorable accounts. As a matter of fact, the press of Toronto speaks very unfavorable of it. Perhaps that may not be regarded as very high authority upon gas matters ; but I simply quote it in corroboration of my own observations. I happen to have a slip cut from the Toronto *Globe* of October 9th, which I will read to the Association simply to show that there is a certain amount of dissatisfaction with the gas, and to give Mr. Pearson an opportunity of replying to it.

MR. PEARSON—I have got it here and will read it for you. This has not been unexpected :

"The gas light throughout the city last evening was very bad, and it has been bad, in a greater or less degree, for several days past. It varies considerably. In some places it is fairly good, while in others it is wretched. Complaints are common and they are quite proper as well. In many public and private houses the light is not more than fifty per cent of what it ought to be."

MR. LITTLEHALES—"The gas light throughout the city last evening was very bad, and it has been bad, in a greater or less degree, for several days past." I simply call attention to that to corroborate my own observations. Now, the tar that Mr. Pearson speaks of is the only available residual product—the only one of any commercial value. I wish Mr. Pearson would give us what the commercial value of it is We have been to considerable cost in building tanks to store it in, and we cannot get rid of it. That, of course, will lessen somewhat the economical value of the article. Hence the necessity of having the thing brought down to dollars and cents.

Then there is the question of leakage. There is something that we can see. If the effect of changing from coal gas to water gas reduces the leakage by ten per cent., or, in other words, if prior to the adoption of this water gas process the leakage was

17.50, and afterwards it was only seven, without any alteration of the main service, that fact certainly deserves our careful consideration.

MR. PEARSON—I referred to the alteration of the twenty-inch main on the front street.

MR. LITTLEHALES—I was under a misapprehension then. If the mains were altered, then the argument that the decrease of leakage was due to the gas, falls to the ground. If the mains were altered, then the decrease of leakage was due rather to the alteration of the mains than to the gas itself.

MR. PEARSON—If you had listened carefully to the reading of the paper, you would have heard what I said. I accounted for the difference by the fact that a main was laid on the front street, and that we reduced the day pressure some twelve per cent. After we reduced our pressure there was a greater supply going to the western and central portions of our city than there was before, and the pressure, as taken at various points, was higher than it was previous to the reduction, and, therefore, the leakage would not be reduced on that account.

MR. LITTLEHALES—Possibly some other members of the Association are under the same misapprehension as myself—that the reduced leakage was on account of the water gas.

MR. PEARSON—I said that I believed it was mainly attributable to that.

MR. LITTLEHALES—That comes to precisely the same thing. If it is mainly attributable to that fact, I think the thing requires some further explanation, because the only difference should have been that due to the different specific gravity. Of course, if it is due to the alteration of the main, then the process should not receive credit for it.

MR. PEARSON—I do not admit that it is due to the alteration of the main, entirely or mainly.

MR. LITTLEHALES—Will you please tell us which horn of the dilemma you take?

MR. BUTTERWORTH—Will you please read that passage again?

Mr. Pearson—Certainly. I do not suppose, of course, that it is possible to remember everything. This is what I said: "Between August 1 and October 16, 1879, about 1,600 yards of 20-inch pipe were substituted for smaller sizes as a trunk main, and between the middle of May and the middle of July, 1880, it was extended 2,200 yards further. The day pressure was considerably increased in July last, in consequence of an increased demand for gas in the daytime." Some of our people were using gas stoves, and complained of want of pressure. "The night pressure on the mains supplying the the principal part of gas consumed was increased about one-seventh in December last, but notwithstanding this, however, the supply was defective. In the middle of July last, when all the connections were made to the trunk main referred to, the pressure was reduced to what it was before. This, however, gave a very much higher pressure in certain localities where there had been a deficiency before, even with the higher pressure, and this and the increase in the day pressure referred to, will at all events, partially account for the increase in the unaccounted-for gas account in the last September quarter, as compared with that of June last." When the largest increase took place in June last, these connections were not made. The using of the Lowe gas sent our leakage account down 7½ per cent. In July, when all the connections were made, although there was a decrease of the night pressure, the pressure was increased in certain portions of the city where there had been a deficiency before.

Mr. Littlehales—So that I understand the reduction was not mainly due to the alteration of the mains?

Mr. Pearson—I did not say that it was.

Mr. Littlehales—Will you kindly state whether this reduction from 17 to 7 is due to the difference in the gas or to the different condition of your mains?

Mr. Pearson—I think it is principally due to the difference in the gas, and partly due to the alteration in the mains.

Mr. Littehales—how much to each?

Mr. Pearson—That is a very difficult thing to get at.

MR. LITTLEHALES—These are points on which our judgment of the process would be formed.

MR. PEARSON—It is a fact that the larger proportion of Lowe gas we use, the less leakage we have. That is a fact which my statements, when carefully read, will, I think, establish.

MR. LITTLEHALES—The lack of definite information in regard to results, I think is to be regretted. I would ask Mr. Pearson if he could not, on some future occasion, give us, in dollars and cents, what it would come to; because, after all, that is the main question, and his balance sheet at the end of the year may not show results that would be entirely satisfactory to us.

MR. PEARSON—I suppose I had better begin and reply to Mr. Littlehales, commencing with the last inquiry. In the first place, with regard to the financial results, I did not think it was exactly fair for me to come here and say how much more money our company has made since it commenced using the Lowe process than it did before. I have embodied in my paper a statement of facts, and have given figures showing certain results. I do not think it concerns this Association to know exactly what benefit the Toronto Gas Company has derived from the use of this process. What the members of the Association want to know is, I suppose, what benefit they could derive from making gas in this way. I think, after they have read my paper carefully, they can make that out for themselves, without my telling them. I am not going to tell exactly how much money we made. I am willing to tell any gentleman privately, and I have no objections to telling Mr. Littlehales privately, but I shall not make a public statement of it. I will simply say, however, that we have made considerable more money during the last year, with about 10 per cent increase of consumption, than we ever made before, notwithstanding the reduction of 25 cents in the price of the gas, on about a one hundred million cubic feet. That is something definite, I am sure. That reduction took place on the first day of October of last year. We are now selling gas to our large consumers—those using 200,000 feet—at $1.50 per thousand, and

to those using less than that, at $1.75. So much for that. In regard to the luminosity of the gas, I am not at all surprised at Mr. Littlehale's remarks. I expected to hear about that. He has made the statement that he has seen the gas when it was only 10 candles. I should like to ask Mr. Littlehales how he knows that it was only 10 candles?

MR. LITTLEHALES—I have the Government Inspector's returns here.

MR. PEARSON—I have them here also, and mine are official.

MR. LITTLEHALES—I was speaking then more particularly from my own observation.

MR. PEARSON—I have the Government Inspector's returns here, and he has never reported the gas lower than the figures I have given in my paper I make that statement most emphatically, and I will make no further observation upon that point.

That there has been complaints in regard to the gas I admit. I believe every gas company has complaints, and I presume Mr. Littlehales himself has had some experience in that direction. We have had several complaints lately, but they have arisen, to a very great extent, from the fact that consumers could not discriminate between quantity and quality. In a great many instances the pipes have been partially stopped, and nothing else was the matter. In every case where this was the cause of complaint, when we have remedied it, the consumers have been satisfied with the gas. It is not an easy thing for persons not accustomed to it to measure the flame that comes from the burner. If it is from 20 to 25 per cent less in size, they do not notice it, or, at least they do not think it is the fault of the pipes. They attribute it at once to the fact that we are making gas by water, and they have a prejudice against it. They say that the want of illumination is because we are using that process. I am going to make an admission in regard to variation, by way of explaining how it happened. On some occasions there has been a variation in the gas, and the reason has been that the inlet and outlet pipes to the holder have been close together, and we make gas so rapidly that some of it has gone

off almost as soon as it has been made. We are going to remedy that by putting in another holder and supplying the gas more thoroughly mixed. I do not admit that there has been any very great variation in the gas at all. I do not admit what Mr. Littlehales says—that the gas has been down as low as 10 candles. I do admit that there has been some variation, from the cause I have just stated. I repeat the statement that most of the complaints that have been made have been attributable to the fact that the pipes have been partially closed up.

Now, in regard to the poisonous nature of the gas. I suppose that most of the members of the Association saw a correspondence which took place between Mr. Littlehales and myself in the columns of the *American Gas Light Journal*, in which I replied to certain statements he had made in referring to the cases of those whom it was supposed were poisoned by the gas. For the information of those members who may not have seen that correspondence, and for the purpose of refreshing the memories of those who have, I will, with your permission, read what I said upon that point. This letter will be found in the *American Gas Light Journal* of August 2, 1880.

The facts as obtained from the proprietor of the hotel are as follows:

"A woman over seventy years of age, very feeble and almost utterly exhausted, arrived by a late train and retired at about 11 o'clock. The porter, as instructed, called her at half-past five the next morning ; he receiving no answer, and fearing from the woman's appearance on the evening previous that something was wrong, immediately burst open the door, and found her lying face downward on the floor, with her head toward the door. There was a strong smell of gas in the room, and the tap was found open. A doctor who was near at hand was called in immediately, and pronounced her dead. Her friends were communicated with, and on their arrival, did not seem surprised at her death. An inquest was not held, because under our existing laws no coroner can hold one without taking an affidavit that he believes that the death took place from foul play.

"I saw the doctor some time after, and on my asking him

what means had been taken to resuscitate her, and expressing my surprise that death should have taken place so soon, said that there was no question about her death, as she was *quite cold* when he examined her. From this circumstance she evidently must have been dead some time before discovered.

"The room in which the woman died was 10 feet by 6 feet by 9 feet, and both the window and door were closed. The burner (which I have) consumed 2½ feet per hour at one inch pressure, which was about that on the building during the period of the escape.

"Allowing that the escape continued six hours, 15 feet in all would have escaped in the room. Now, as the Lowe gas, as analyzed in Canada, contains less than 20 per cent of carbonic oxide, but three cubic feet, or .55 per cent, could have been present at the expiration of the six hours. Apparently the woman was dead some time before, when a smaller proportion was present; and, moreover, was lying on the floor where there would be less gas than in the upper part of the room. Could the carbonic oxide in the gas or the gas as a whole, have been the sole cause of her death? I do not believe it; and in support of this opinion, give the following instances in which people have recovered after inhaling Lowe gas here, and in one of which a very much larger quantity must have been inhaled.

"A man at one of our hotels retired at 11 P. M., blew out his gas, which continued escaping until 5 P. M. the next day—18 hours. The room was only 10 feet by 8 feet by 9 feet. The window and door were shut during the whole time, and fitted very closely, and the burner consumed fully three feet per hour—the person recovered, though with much difficulty. This happened in February last, when we were making about four-fifths of Lowe gas.

"The other case is that of a young gentleman who, by some means or other, turned the gas on after extinguishing it, and inhaled it, in a room with doors and windows shut, for about four hours. I have not got the size of the room or the burner. He was found lying on the floor quite insensible. He recovered on restoratives being applied—went to church on the

same morning, it being Good Friday, and to a party in the evening. He merely complained of a headache during the day, and was as well as ever the day after. The gas was all Lowe gas.

Our men employed in laying mains say they are overcome with the gas a little quicker than they were with coal gas, but *recover sooner*, and, after a sleep, always feel as well as ever."

I dispute the case of the woman Mr. Littlehales refers to.

MR. LITTLEHALES—Tell us about the other cases?

MR. PEARSON—I will tell you about one of them. I have not in my possession definite information in regard to the other.

MR. LITTLEHALES—When did the accident to this lady take place?

MR. PEARSON—The date of that ————. I do not know, Mr. Chairman, whether this is a relevant question or not. I suppose it is admitted that every gas will kill people. I do not suppose that the question before this Association is whether the Lowe gas will kill people or whether it will not kill people. I can give the cases; but is it desirable that we should here discuss a question of this kind, knowing that all gas is poisonous? I will admit that Lowe gas is poisonous, and you must all admit that coal gas is poisonous also. If the Association desire it I have no objection in the world to going on and giving further information; but I do not know whether it is desirable that I should do so.

THE PRESIDENT—I suppose the point that Mr. Littlehales makes is that the Lowe gas is much more fatal in its effects than coal gas.

MR. LITTLEHALES—It is something like the reputation of a certain kind of whiskey—it kills at forty rods. The question is whether with small burners passing about twenty-five feet into a room in about six hours, the gas will kill. Giving them the benefit of the doubt in regard to the woman who it was proved was sick before she was subjected to the influence of this gas, there have been two subsequent cases, one occurring about a fortnight ago, and the other about a month ago. The

first one has been referred to. The last case, occurring about a fortnight ago, was that of a man in the ——— hotel. He had been subjected to the gas for some few hours, and he died. Now, that is three deaths within about four months. Taking that as one third of a year, there would be an average of nine deaths a year, which is a pretty big bill of mortality.

MR. PEARSON—Mr. Littlehales forces me to make a statement to satisfy you that he is incorrect in his conclusions.

MR. LITTLEHALES—Mr. Pearson challenges my statement about the quality of the gas. I read a paragraph from a Toronto paper—

" Alderman Bonstead presented four reports by the Government Inspector in reference to the gas supplied to the city by the Toronto Gas Company. They showed the illuminating power of the gas (twelve candles being the standard) to have been on October 5th, 12.08 candles ; on October 19th, 10.62; on October 25th, 14.67 ; on October 30th, 11.54.

MR. PEARSON—That is manifestly incorrect.

MR. LITTLEHALES—This was last October.

MR. PEARSON—We were making coal gas then, gentlemen.

MR. LITTLEHALES—Last October ?

MR. PEARSON—Yes, sir. We were unable to use the Lowe process exclusively because we had not then the means of properly purifying the gas. That is a very different statement. [Laughter.]

MR LITTLEHALES—But you said you commenced the Lowe process in February, 1879, and this is October, 1879?

MR. PEARSON—Yes ; I said we *commenced* using the Lowe process at that time ; but we did not use it exclusively. My paper only goes back to February, 1880, since which time our gas has been made by the Lowe process alone.

MR. LITTLEHALES—I am speaking about your statement that you commenced the Lowe process in February, 1879, and this refers to October, 1879.

MR. PEARSON—I have already said that we *commenced* the Lowe process at that time ; but at the dates given there, we

were not making over one-third of our gas by the Lowe process for the reason that we had not the means of proper purification. You can not put that down to Lowe gas.

M. LITTLEHALES I merely wanted to call your attention to the fact that you might have an opportunity of explaining it.

MR. PEARSON—I believe I have done so. As Mr. Littlehales has made a statement in regard to one of the cases where death ensued from the effects of the gas, I will give you the facts as published, and you can form your own opinion whether, under the same circumstances, coal gas would not have been fatal. The man retired between six and seven, and the gas was turned off or blown out at half-past twelve o'clock. He was discovered at half-past five the next morning. At the pressure at the hotel the consumers's burner would pass six feet an hour, making some thirty feet. The room was 18 by 10. The windows were bull's-eye windows in the top story, and were closed perfectly tight. The man lived about five days. He inhaled the gas from half-past twelve until half-past five in the morning. There is no question but that the gas is poisonous. You see, however, that the man was a very long time under its influence. Furthermore, his friends say he was subject to brain trouble before that time; but I will admit that was a case of gas poisoning.

MR. LITTLEHALES—Which case do you refer to?

MR. PEARSON—To the man who died at the——hotel.

MR. LITTLEHALES—What about the man who died at the La Salle Institute?

MR. PEARSON—I have not full information in regard to that. Mr. Littlehales smiles incredulously. He may smile if he likes. I have here a statement that was published in regard to it which contains all the information I have upon the subject—

"An old man, 61 years of age, employed as a tailor at the La Salle Institute, turned the gas on in his bedroom; but as it did not ignite when he applied a match he thought there was none in the pipe, and forgetting to turn the tap off again he went to bed and died on Saturday from suffocation by gas. Not appearing for breakfast, it was supposed he desired to

take a sleep, and no person went to his room until about one o'clock the next day, he went to bed early in the evening and at one o'clock the next day, he was found in a state of unconsciousness. He lived a few days afterwards and then died.

Sometimes it is not desirable for gas companies to inquire too closely into these cases, because it creates a great deal of noise, and no good results from it. I did not think it desirable that I should make any further inquiry after that statement. Mr. Littlehales stated that three deaths had occurred from poisoning by the gas within a few months. I do not admit but one. It is true that these accidents occurred within a few months ; but I cannot, more than anyone else, account for the fact that very often a great many troubles come together, or, as the saying is, "misfortunes never come singly." I know a gas company that blew up two gasholders, one after the other. At that rate how many gasholders would be blown up in 20 years? Twenty years ago we were unfortunate enough to blow up a man's house with coal gas. The same year, or the next year, there were two girls poisoned in a hotel by coal gas, and very near the same time a person was poisoned in a house by the gas leaking. Here was a series of accidents, one of those strange events which sometimes occur that we cannot account for. There were four accidents from coal gas within about a year. At that ratio we ought to have had, within 20 years, 80 accidents, but we have not. Mr. Littlehales' argument upon that point, therefore, does not prove anything. There is no question but the gas will kill people. I admit that, and I suppose coal gas men will admit that coal gas will kill. I have answered Mr. Littlehales' question about profit and loss. What benefit our company derived from the use of the Lowe process does not so much concern this Association as does the question of what benefit it is likely to be to you. It has been of great benefit to our company financially. I say that without hesitation. I suppose Mr. Littlehales will ask if the cost of the plant and interest is included in my statement.

MR. LITTLEHALES—Undoubtedly.

MR. PEARSON—In reply to that I will say that so far as we are concerned we were going to build a new retort house any-

way this season, and we intended, in connection with the retort house, to build a purifying house. Now, the only expenditure we have been at in that respect was merely anticipating, by a couple of years, what we would have done in any event. The expenditure for the Lowe process was, of course, a little more than we would have expended to put in retorts, hydraulic mains and other things; but, taking the whole expenditure for the Lowe process, we did not lose anything in interest, because we have not now to store our bituminous coal, which, as Mr Littlehales knows, has to be laid in in advance of the season's work. We would have had to lay in from sixteen to seventeen thousand tons of bituminous coal for the winter and the next year's consumption. We would have had to purchase property in order to have stored that coal for a large works. Under the present system storage room for four thousand tons of coal is ample. We take that out, and other things that we have not had to supply, and the interest is in favor of the Lowe process so far as we are concerned. As to what you may do, that is a matter for yourselves.

MR. HELME—I think, with Mr. Pearson, that we all know that carbonic oxide will kill. The only question is whether gas made from the Lowe process is more injurious in this respect than gas made from coal. This thing of people going into hotel rooms and blowing out the gas and going to sleep is something that I cannot very well understand, and is certainly something which we cannot control. The Almighty has given to gas one thing which ought to suggest to people that there is danger in it, and that is its very pronounced and disagreeable odor. If a man will not take advantage of that hint, and will blow out the gas when he goes to bed, we are certainly not responsible for it. But we are responsible for this—whether the kind of gas we supply is less detrimental to health than another kind; and that which is the least detrimental to health is the kind we ought to supply to our consumers. Now, I do not know whether Mr. Pearson has any information on the subject, of whether any member of the Association has any facts by which we could tell whether the Lowe gas is any more poisonous than coal gas. I have heard a gentle-

man who is using Lowe gas, and has used it for some time, and who is making it, say that there has been some talk about it, and that he thought there was something in it; but that, at the same time, his consumers did not complain of it. That is, after all, the real question we are interested in. If a man will sleep where gas is escaping, whether it is Lowe gas, or coal gas, one will kill him as surely as the other, if he is under its influence long enough.

MR. COGGSHALL—Mr. Pearson has presented a paper in which (though we may not agree with him as to his conclusions) he has given us certain facts which every gas engineer present can compare with his own results, and decide for himself whether or not there is any profit in adopting the Lowe process. Having gone into the matter so thoroughly and completely as he has, I move that a vote of thanks be tendered him.

Carried.

MAJOR DRESSER—This matter of naphthaline that was referred to by Mr. Pearson is one of a great deal of interest. It used to be supposed that there was no naphthaline in oil gas works, but here is a little specimen—a solid cylinder of naphthaline four inches in diameter, and about a foot long, was shown—evidently naphthaline (laughter), from the inlet of the holder at the Municipal gas works, where water gas is made. It was made by simply dipping a stick into the trap in this way and lifting it up and down. It is an interesting specimen. I suppose you gentlemen know what it is; if you do not, I have the pleasure of informing you that it is naphthaline. (Laughter.)

MR. PEARSON—Major Dresser has produced a specimen from the Municipal water gas when Mr. Allen could not speak upon the subject of water gas. He has given us something from another process that is not the Lowe process, and I do not think it is quite fair that he should present it here as a specimen from the Lowe process in Canada. (Laughter.)

MAJOR DRESSER—I beg Mr. Pearson's pardon. I had supposed the discussion on his paper was ended, from the fact

that a vote of thanks was extended to Mr. Pearson. Mr. Pearson, in his paper, referred incidentally to naphthaline, and I simply presented this specimen as a piece of pleasantry, and as a matter, perhaps, of some interest.

MR. SOMERVILLE—Do the coal gas and the Lowe gas mix?

MR. PEARSON—Yes; they do mix; there is no question about that.

MR. STARR—I understood you to say that the inlet and outlet of your holder were so near together that the gas would go out about as fast as you made it. Is there a difference in your case at different parts of the charge?

MR. PEARSON—I admitted that on some occasions this was the case; but we always try to prevent any such thing from taking place. I admitted that there was some variation in the gas, but not the variation Mr. Littlehales referred to; and I gave as a reason for that variation a circumstance which we can prevent in the future.

MR. BUTTERWORTH—Did I understand you to say you made, per charge, 4,500 feet?

MR. PEARSON—On an aveaage, 4,000 feet.

MR. BUTTERWORTH—And you used 59 pounds of coal?

MR. PEARSON—In the generators.

MR. BUTTERWORTH—How many pounds in all?

MR. PEARSON—We used 70 pounds of coal altogether.

MR. BUTTERWORTH—Seventy pounds for 4,500 feet?

MR. PEARSON—For one thousand feet, and four gallons, or a little under, of crude petroleum.

MR. BUTTERWORTH—How do you get seventy pounds of coal and four gallons of oil at a cost of seven cents?

MR. PEARSON—I did not say that. The seven cents refers to the labor in production. When the paper is published you will be able to understand a little more clearly.

MR. FORSTALL—I think it is possible for Mr. Pearson to give us a statement of results in such a way as not to make public the financial affairs of his company. I think we can get at it satisfactorily if he will state at how much he puts the

cost of the Lowe gas in the holder. Supposing your coal gas to cost you from 40 to 50 cents per thousand feet in the holder, what does your Lowe gas cost in the holder?

MR. PEARSON—The Lowe gas costs us in the holder about 15 cents less than our coal gas, in addition to whatever benefit we may derive from the non-condensibility of the gas in the pipes. That depends a great deal upon the price of coal. We have saved fully 16 cents a thousand feet as compared with the price it cost us to put our coal in the year before we commenced using the Lowe process. We make one hundred and forty millions of feet, and you can easily figure up what the saving is.

MR. FORSTALL—Does that 16 cents refer only to the difference in the amount of coal used, or does it include everything?

MR. PEARSON—It includes everything. It is our net gain over the coal gas process.

MR LITTLEHALES—Taking the loss of interest on your old retort house?

MR. PEARSON—I do not admit a loss of interest. That is a matter for ourselves.

MR. BURTIS—Have you, in repairing meters, noticed any peculiar effect of the gas on the meters. Some repairers have told me that they have noticed a difference, and could tell what gas had been used?

MR. PEARSON—We have found no difference in the meters.

MR. FORSTALL—In getting at this difference of 16 cents in cost of the Lowe gas, at what price do you estimate coal, and at what price naphtha?

MR. PEARSON—We had two kinds of coal. The bituminous coal, I think, cost us, put down, $4.35. The hard coal about $3.90. The crude petroleum costs us about four cents a gallon. You can make the figures for yourself.

MR. STARR—Have you found in them any sediment or gummy substance?

MR. PEARSON—No, sir; I have heard of some instances where there was a little collection of water in the meters.

MR. STARR—We once used a meter where we found the whole interior surface covered with a gummy substance about half an inch thick.

MR. PEARSON—There could not have been a proper purification of that gas.

I am very much obliged to the members of the Association for the kindness and courtesy with which my paper has been received.

THE PRESIDENT—I wish to say one word in reference to the ruling of the chair on the question of order. I think the discussion between Mr. Littlehales and Mr. Pearson was perfectly legitimate. It was not upon the general question of gases, but was in regard to certain facts in the City of Toronto, which indicated that this gas was of a particularly poisonous nature. These facts were discussed at considerable length. When the discussion had nearly been brought to a close, Mr. Helme made a short speech upon the general question, which, of course, was out of order; and had he not stopped so soon, I should certainly have called him to order. Mr. Allen then began to speak upon the question of the poisonous nature of gases generally. I saw the discussion was running into a wrong channel, and I exercised the prerogative of the Chair and called him to order just as I would have called any other person to order who was discussing a question clearly irrelevant to the subject before us. It was not from any personal objection to Mr. Allen speaking, or from any personal feeling at all. But I must, while sitting in this place, do my utmost to conduct the proceedings of the Association in a proper manner, and keep members to the line of discussion which is relevant to the subject matter directly before us. I conceive that to be the duty of the Chair, and unless I am overruled by the Association itself, I shall continue to perform that duty to the best of my ability. I did not intend to allow Mr. Helme to go on with his remarks to any length; and if he had continued I should certainly have called him to order.

Mr. Allen—I would have accepted the reproof most cheerfully if the Chair had called the first gentleman to order who was out of order.

The President—It is very likely the Chair may not have done its duty. I do not claim to be perfect in these respects. If you refer to the facts that were in controversy between Mr. Pearson and Mr. Littlehales, I think, the discussion of those facts was perfectly legitimate, and that it bore directly upon the question. When it came to the discussion of the question whether one gas is more poisonous than another, that is quite another matter, and one which I think was entirely outside of the subject before us, the discussion of which was clearly irrelevant.

Mr. Helme—I accept the President's position. I had no intention of entering upon a discussion of the poisonous nature of gases in general. I simply thought that Mr. Pearson might be able to give us some information that would throw light upon the subject as to whether Lowe gas was particularly poisonous, and I was simply acting upon that theory.

Afternoon Session.—October 14th.

The President—If that matter is disposed of, I would ask Dr. Love, who is present, to favor us with some remarks on burners. If he will please come forward, we will all be very glad to hear from him.

Dr. Love spoke as follows:

I regret that the duties of my position have prevented my completing the series of experiments which I had planned, and a short account of which I gave at your meeting last year. I have made certain experiments to determine what burners should be adopted in testing for illuminating power the gases in the city of New York. There the conditions are somewhat peculiar, and do not exist throughout the country.

Three years ago the photometric stations of the Department of Public Works were established, and the burner question re-

ceived considerable attention. The contracts which the city made with the companies contained a clause—taken from English contracts—to the effect that the burner to be employed should be an Argand and 15 holes, with a 7-inch chimney, by which burner the gas should give the light of 16 candles. The best burner corresponding with this specification was the Sugg-Letheby, and consequently it was used, although I stated that it was out of date, and earnestly recommended that a change be made. It has taken considerable time to bring about the change, as it was not affected until January last. The companies are now allowed to select such burners as they find best suited to their gas, provided it is within the reach of the consumer.

As the proposed change would show the gas to be of higher illuminating power by at least 2 candles, and so allow the companies to lower the quality by that amount, it was necessary either to raise the standard from 16 to 18 candles, and test by the improved burner, or to allow the companies to use the improved burners provided the illuminating power did not fall below the 16-candle standard as indicated by the Sugg-Letheby burner. As some companies preferred the latter plan, it was adopted.

The coal gas throughout the country will probably average from 14 to 16 candles, while the average illuminating power of the coal gas of New York is from 18 to 20 candles I made a series of experiments with Argand burners, having in mind the requirement that the burner adopted should be one that could be used by the consumer. For this reason I thought best to leave out the Argands of foreign manufacture, on account of their high price ; and as the Argands of American manufacture gave results little or no better than the flat-flame burners on this quality of gas, I decided that, on the whole, it would be better to adopt a flat-flame burner.

As I stated in the paper read at your last meeting, coal gas and naphtha gas should not be tested by the same burner, and as the flat-flame burner was decided on for coal gas, it seemed clear that the flat flame burner should, with even greater reason, be used for naphtha gas.

There are a great many flat-flame burners to be found in this country, a large proportion of which possess no specially redeeming feature. In regard to the flat-flame burners of foreign manufacture, there is one made by Mr. Bray, of Leeds, which, at about the time the question arose in New York, was attracting considerable attention, and with which I made a number of experiments. I learned that the burner was to be put in the American market, at a comparatively low cost, in the hope that it would replace burners of home manufacture.

A comparison of the Bray burners with the better burners of our own make showed, in the testing of coal gas, very little difference in the results; but with the naphtha gases the Bray burner proved somewhat superior. Before adopting a burner, I addressed a communication to the several gas companies of New York, giving the results of my experiments, and asking them if they wished to express any choice as to a burner. The Manhattan Company was the only one which offered any suggestions on the subject. They recommended a burner called the "Empire," which was being introduced by them for their consumers, and which corresponds with No. 4 or No. 5 of the Bray series. It is a brass burner with a screw check, and in the present instance was provided with a 5-foot tip. This burner is now used in testing the gas of the Manhattan and Harlem Companies.

The burner decided on for the naphtha gases was Bray's slit union No. 7, and, so far, I have had no reason to regret the choice. As to getting the maximum amount of light from that gas, I think this burner does it as satisfactorily as any I have seen.

The experiments of the past year have strengthened the opinion expressed, that no one burner can be adopted for the various illuminating gases made in this country. With a coal gas of from 14 to 16 or 17 candles, better results can be obtained by the use of improved form of argand; but with the various gases involving the use of naphtha, there is great advantage in the use of the flat-flame burner.

The President—There is now no business before the Association. Mr. Page is to deliver a lecture this evening, but it

is now but a few minutes after four o'clock, We have still nearly an hour that we might spend here.

MR. FORSTALL—Mr. Goodwin has some statistics in regard to heating by gas, but he does not seem to be present.

THE PRESIDENT—As there is no business before us, and as Mr. Goodwin is not ready, we might give half an hour to Mr. Allen. [Applause.]

MR. ALLEN—I do not know that I ought to accept, at this late hour, the very kind invitation that has been extended to me. The time is so limited that if I should undertake to go into anything like a statement or argument in relation to water gas, I could not do it justice. I can only make a few general remarks in regard to the water gas process, and that is all I ask to do at this time. I shall confine myself particularly to the process which we call the Allen-Harris process, which we have been running at Poughkeepsie for five years past. I will say in regard to the quality of the gas, which has a good deal to do with any process, that we have received the universal commendation of our consumers, and I think that there is no company making a better or more uniform gas than we are, which we call water gas. It has been very frequently stated by coal gas men that the gas is poisonous. Several gentlemen of prominence have said to me that it was poisonous. They were, at the same time, smoking their cigars. I said, "Gentlemen, it has been charged that tobacco is a deadly narcotic poison." I was recently in New York, and I had a pamphlet put into my hands, showing that poison enough could be extracted from one pound of tobacco to kill 150 men. But tobacco is still used without fear of results. Why? Because it is used in such a diluted form, and not as an extract, that many consider its use beneficial instead of injurious. So in regard to carbonic oxide. Its use in gas for illuminating and heating purposes is in such a diluted form that no danger need be anticipated.

We have delivered more than 1,000,000,000 feet of water gas in Poughkeepsie, and not a single complaint of any injurious effects have ever been suggested. I consider carbonic oxide one of the most important elements in illuminating gas.

Hydrogen and carbonic oxide are permanent gases which produce the highest calorific intensity of any of the gases. It is the calorific intensity which produces the high candle power of the gas, and prevents its smoking. You are already aware that carbon is a mineral, and not a gas. It has the power of assuming the form of gas. It needs a permanent supporting gas to be present when it is volatilzed to take it up and carry it off. Having that permanent gas ready in sufficient quantities, the moment this gas is volatilized (whether from coal or from oil, it makes no difference), there is a volume of that permanent supporting gas to take up and chemically unite with the carbon, and carry off to the holder a pure, brilliant, and incondensable gas.

The difficulty with you is this—that you buy the cheapest coals; you do not use the rich cannel coals that we have in great abundance in this country, and for which there is but little call, except to the extent of from 5 to 10 or 20 per cent for enriching. You do not use these coals; you cannot use them under the old process. You have, even in the cheaper coals, more carbon than you can utilize to advantage. You must make a supporting gas. What do you produce? You produce carburetted hydrogen, or marsh gas, which forms 45 per cent of the volatile carbon in the ordinary coal. It requires only 7 to 10 per cent of the luminants to produce a 16-candle gas. What becomes of the rest? Look at the incrustations in your retorts; look at your tar; look at the trouble you have with naphthaline, stoppages of the pipes, and all those things, because you do not have a supporting gas to take that up the moment it ought to be taken up. If it is not taken up the moment it is volatilized, it is lost. That is the trouble. You were here discussing the subject of how you can keep your standpipes clean. If that carbon is taken up when it is volatilized, by the necessary supporting gases, there will be nothing deposited. If we can use clear oil, which is nearly all carbon, and have the gas carried off without any stoppages of the pipes or incrustations in the retorts, can you say anything against the process? We have done it for five years, and are doing it to-day.

MR. CARTWRIGHT (Philadelphia)—How?

MR. ALLEN—Our system is unique. There is no other one that is running in the same way. We are running our retorts *continuously*. I have a little sketch of what we call a "set," which consists of two hydrogen benches, and an oil bench in the centre. The water gas is made by sending superheated steam in finely divided jets through incandescent carbon. In that way the steam is decomposed. The more perfectly that is done, the more perfect will be your gas. From the hydrogen benches the hydrogen or water gas is conducted through a vaporizer, into which oil is turned at the same time, and, becoming volatilized, it mingles with the water gas and is swept down into the lower retort of the oil bench, and on through the upper retort to the standpipe. Two hydrogen benches make sufficient water gas to be carburetted by one oil bench. This is all brought up through the centre bench, and is carried out by one standpipe, passing through one uniform degree of heat. You work differently. You put your material into your retorts, each of which has a standpipe. The most volatile and the best part of the carbon goes up in a black smoke out of the standpipes before your heats are high enough to make gas. Your trouble comes from that. You are wasting carbon. and that forms the stoppages in your pipes. Naphthaline and ammonia and impurities in your gas are formed how? By the continual drawing and charging of your retorts every four hours, your heats are down and up. When one equivalent of nitrogen and three of hydrogen unite over a red heat, you form ammonia, you do not form illuminating gas. So, with different heats you form different combinations. Many of these combinations are impurities that you do not want. You then go to the expense of purifying the gas from these impurities. How much do you purify per bushel of lime? I believe that it is generally from 5,000 to 7,000 feet.

MR. CARTWIGHT—That is about half.

MR. ALLEN—From 14,000 to 16,000? I have not heard it stated as high as that before. I have called upon a great many gas engineers. Perhaps they have not given me the facts, but I have never heard it placed at so high a figure. Lime varies.

We are using the ordinary slaked stone lime from Glens Falls. We are purifying 35,000 feet on an average per bushel of lime. I only mention this to show what I think is evidence of the superiority of our process. If you run your works at low heats, you will make poorer gas than when you run at high heats. But when you run at high heats the discussion here has shown that you have even greater difficulties to contend with. But the demand of the community is to-day for good gas. You must run high heats. You cannot run them in a way to make poor gas. You must make good gas, of high candle power. A difficulty has been stated to me within a few weeks by prominent gentlemen in Brooklyn, who have studied this subject. They have said: "Mr. Allen, if we could only get the white light that you have in your gas, we would be all right." I said to them, "That is just what you are lacking. You have a yellow rim around your flame which is simply unutilized carbon. You have not strong enough combustion in your gas. You cannot get it in the ordinary process of making coal gas. Your proportion of hydrogen and carbonic oxide are not sufficient to utilize the illuminants.

Now, in regard to the poisonous effect of carbonic oxide, let me say that it is all a bugbear. There is nothing in it. I have a certificate from Prof. Cooley, of Vassar College, a very eminent chemist. He certifies that he has used our gas for five years with great satisfaction, and he continues to use it, although he is fully informed of its component parts, without the least alarm in regard to the consequences. We have the certificates of Prof. Silliman and Prof. Wurtz in regard to the gas. They fully analyzed it. They certified that water gas will vitiate a given quantity of air in a room to a much less extent than coal gas. If you think of it for a moment, you will see that it is so. Every particle of oxygen that is in the carbonic oxide supplies just so much oxygen which combustion requires, but which coal gas must take from the atmosphere in the room. Every particle of oxygen in the carbonic oxide is so much help to the combustion of the gas, and therefore does not vitiate the air in a room as much as if there was not that quantity in it. This is self-evident. There have been three

cases of blowing out gas at Poughkeepsie within the last two years. One of them was that of a young gentleman who came from Texas to attend Eastman College, and put up at the Morgan House. He went to bed at about 11 o'clock on Saturday night, and blew out the gas. He lay there until 11 on Sunday morning. Not making his appearance, they broke open the door and found him lying unconscious near the door. A physician who lived in the house was called, and the young man, being exposed to the air, immediately revived. He was not injuriously affected at all. He took tea at the public table and went to the school in the morning. On another occasion, two farmers came to the Northern Hotel and staid over night. They blew out the gas, and were in the room all night. In the morning they got up and went down to breakfast. They thought the air in the room did not smell as pure as country air, but they were not injuriously affected at all. In both cases ordinary 4-foot burners were left open, and the doors and windows were closed. When you speak of water gas as being dangerous, it is a mistake. It is not as dangerous as ordinary coal gas. I do not believe there is a case on record where a person has been exposed to coal gas the same or one half that length of time and survived.

Water gas has been used by eminent physicians in Germany and France as an anesthetic without any deleterious effects. Carburetted hydrogen, or marsh gas, which is the basis of ordinary coal cas, cannot be used for that purpose. It kills instantly.

As to the cost, like Mr. Pearson, I have no objection to telling any gentleman of the Association, but I do not think it would be fair to ask me to state it publicly. I believe that I can say, however, that we can show better results from our works than can be shown in behalf of any company here in regard to the net profits from the same consumption of gas, and if I cannot I will give it up. I would be glad to show these papers to any gentleman who would like to see them. We have been working at the system for ten years, and we think we have brought it to perfection, and that no one can find fault with the results if they will only examine them.

MR. FORSTALL—I would like to ask Mr. Allen if this process is in use in other places besides Poughkeepsie?

MR ALLEN—No, sir.

MR. FORSTALL—Has it ever been tried in any other place?

MR. ALLEN—Yes, sir.

MR. FORSTALL—Has it ever been given up after having been tried?

MR. ALLEN—Yes, sir.

MR. FORSTALL—What were the reasons for giving it up?

MR. ALLEN—We put it in some years ago in New Haven. That was the first place. Judge Boardman was then the President. It was run for five years under the supervision of Professors Silliman and Wurtz, and it was probably subjected to the longest and severest scientific analysis that any gas ever had in this country, and, perhaps, in the old country. I wanted to be thoroughly satisfied in regard to the scientific basis of the process before I went further with it. We commenced at Fair Haven, where this work was done, with only three benches, afterwards it was put into four benches in the New Haven works. They were very small, old-fashioned benches, originally made for iron retorts, and did not allow a good draft. Mr. Cox, the engineer, unintentionally did a thing which was very much against us. He thought to economize the heat by putting the boiler up over the benches. He made a great mistake, for when he had a direct draft upon his arches he had no steam that answered our purpose. When he could get good steam by having a draft under his boiler he had a poor draft under the arches.

MR. CARTWRIGHT, of Philadelphia—Where did his heat go to?

MR ALLEN—Mr. Wood, of Syracuse, can tell you about that. Having the boiler up over the arches, it formed an indirect draft, and this destroyed the necessary draft under his benches. He could not get good heats under his benches and boiler at the same time. We have now got it arranged so that we get the best kind of steam with our boiler over the arches, and the best kind of heats under the benches by having an air blast, and

dampers between the chimney and the furnaces. I believe all who have visited our works admit that we have splendid heats under our benches, and we have fine steam also. But at Fair Haven we labored under the disadvantage that I have spoken of. Their Board ordered a new set of 16 benches, or eight double benches, to be put up for our process. They had them all built, and Mr. Cox ordered the superheaters to be made, and he ordered them to be one inch larger each way than we made them. By mistake they were made one inch smaller each way. He had 40 ordered and 30 were sent up. We did not want them put in because they were too small and would probably prove a failure. They had to fire up the benches, and that prevented our process from going in there. Judge Boardman, who by that time had become a good friend of our process, died. I have had no means of knowing what the difficulty was subsequently; but the process did not go in afterwards.

Mr. Libby, the President of the Citizens Gas Company, in Brooklyn, made an arrangement for our process, and put in three benches--that is two hydrogen and one oil benches. They ran them one year—1874--and, as Mr. Libby himself said that, although making one-third, or less, of the gas made, the whole was so much improved that complaints were reduced from 30 or 35 a day to four or five, or a merely nominal number, the gas being so much better than before. They used only 5,000 tons of coal that year, instead of 18,000 tons as used formerly. Coal gas interests, however were not satisfied. Finally, in 1875, they were ordered to go back to coal. They went back. Now, for the result. There was trouble amongst their consumers. It was said the trouble came from Mr. Libby putting in the new process. He resigned; but before resigning he sold every share of his stock except ten from $1.20 to $1.50. They went back to coal, and their stock is selling at .60. The Boston Gas Commission published the fact, as reported at the office of the Citizens Gas Company, that in 1874 they made more gas than they did in 1875, and they charged their consumers in 1875 $50,000 more for gas than in 1874, and made $8,000 less money. Dr. Wood, one of the commissioners, told

me these facts, and they were afterwards published as I have stated them. They are none of my getting up. They are facts; and yet they persisted in going back to coal. Now, they have an opposition water gas process in Brooklyn. and the President of the Citizens Gas Company has made an arrangement with that company to supply his company with water gas. Those who know the facts must exercise their own judgment as to whether or not they have been treated any more fairly than they would have been treated under our process. If you will look into the water gas process, gentlemen, you will find that there is a good deal more in it than you perhaps are disposed at present to admit.

MR. FORSTALL—How long has it been since the process was tried at Fair Haven ?

MR. ALLEN—Nine years—When we established ourselves at Poughkeepsie we were desirous of demonstrating our process to the satisfaction of gas men. They said, run it a year and let us see what it will do. We ran it a year and they said run it two years, and we have run it five years. We try to convince gas men by facts and figures, and not by threatening opposition works. If they can make better and cheaper gas than we can, we do not expect them to adopt our system. But if they cannot, I believe it will be to their interest to come and see us. I am only saying what I believe to be for the interest of the gas companies. The community demands a good and cheap gas. I say we can make it cheaper and better under our process and divide the profits with the consumer.

MR. CARTWRIGHT, of Philadelphia—I think in justice to Mr. Pearson, who was kind enough to mention the cost of his gas in the holder that, as Mr. Allen has drawn a parallel himself, he should give us the cost of his gas in the holder. Then we have some standard of comparison; otherwise we have not.

MR. ALLEN—I will give it to you. or to any gentleman here; but if I give it to the Association as a body I ask that my figures should not go upon the record.

THE PRESIDENT—It will not be reported.

Mr. Cartwright—It can be omitted from the regular report of the proceedings if you desire it.

Mr. Allen—I am not willing to give the figures here publicly unless it is with that understanding.

Mr. Cartwright—We are called upon to judge of several processes by a comparison; and yet, when we bring these men to the crucial test in order to form a judgment, they are not ready to give us the facts and figures that are necessary in order to form a correct estimate of the value of their processes, and we know nothing about them unless we try them. Those having these processes, and advocating them, should be armed at every point so as to show to the fraternity what they are doing. We all know pretty nearly what coal gas costs us put into the holder. Mr. Pearson has kindly given us the cost of his gas in the holder, and we have it in other cases of the Lowe process; but we have never heard, or I have not, at all events, of the cost of gas in the holder by the so-called Allen-Harris process. So far as I am concerned, I would like to hear it; and, if Mr. Allen desires it, we can leave the figures out of the published report.

Mr. Allen—I would rather my figures should not be published, not that I would say anything here, or produce any figures that were not true; but, for obvious reasons, however, I do not wish them made public.

Mr. Ludlam—I do not think Mr. Pearson gave the cost of his gas per thousand. Under these circumstances I do not think Mr. Allen should be called upon to give the cost of his based upon what Mr. Pearson said.

Mr. Pearson—I gave the cost in the holder, and I gave the quantity of material employed. You can draw your own conclusions from that.

Mr. Allen—I will make a statement similar to that of Mr. Pearson.

August. 1880.

Gas manufactured......	1,760,600 feet.
Average daily consumption...	57,213 feet.
Average candle power.............	17.63 candles.

Materials used and cost per 1,000 feet in holder—

14.287 tons of stove coal, at $4.75....	$67 00
41.422 tons of grate coal, at $4.45....	183 34
1.317 tons of chestnut coal, at $2.71.	3 10
7,760 gals. naphtha. at 3½ cents	271 60
Labor in works, 4 men..............	201 50
Total	$726 54

September, 1880.

Gas manufactured..................	1,937,300 feet.
Average consumption......... ..	64,577 feet.
Candle power..	17.89 candles.

Materials used were as fellows—

14 59-2240 tons of stove coal, at $4.75........	$66 62
44 1098-2240 tons of grate coal, at $4 45......	198 00
7 2200-2240 tons of chestnut, at $2.71.......	21 65
8,561 gals. naptha, at 3½ cent..............	299 63
Labor in works, 4 men................	195 00
Total	$780 90

MR. PEARSON—Could you give us the cost for material separately? You have given us the cost for the month. I do not think all of us have taken the figures down. You have stated the cost in the holder. How much of that was for material, and how much for labor?

MR. ALLEN—I have stated each item.

MR. PEARSON—You gave it for the whole month. You gave so much material used in the manufacture Some of us did not take it down. Did you give the amount per 1,000 feet?

MR. ALLEN—I gave the cost of all the materials.

MR. PEARSON—What I want to know is, how much per thousand feet it cost you for material—for oil and for coal—

and for how much labor? Will you kindly give us that? You stated that it cost so many dollars for work for the month, and so many dollars for material.

MR. ALLEN—I have stated that the whole amount manufactured in September, 1880, was 1,937,300 feet, and that the whole cost was $780.90 With the same help and about the same fires we could have made an average of about 100,000 feet per day, with the only additional cost of the necessary oil, which would have reduced the cost of the manufacture very materially

MR. PEARSON—Will you kindly state how much it cost per thousand feet for material. and how much per thousand feet for labor?

MR. ALLEN—I have not calculated it in that way.

MR. BUTTERWORTH—Does that include the amount paid for clerk hire?

MR. ALLEN—It includes all the cost of labor and materials in the work of putting gas into the holder.

MR. FORSTALL—I move that a vote of thanks be tendered to Mr. Allen for his remarks.

Unanimously adopted.

THE PRESIDENT—Mr. Goodwin is, I understand, prepared to make a statement in regard to heating by gas. If he will now come forward we shall be glad to listen to him.

Mr. Goodwin spoke as follows:

I have frequently been asked as to the heating power of gas stoves, and as to the best form for utilizing the heat produced by the combustion of gas in them. These questions cover considerable ground. In order to answer them as intelligently as possible, I have made a few experiments, and will give you the result.

I constructed a portable room, so arranged that the walls could be set up in a large room and removed at pleasure. Its size was 8 × 10 feet, and 10½ feet high—equal to 672 cubic feet of space. The entrance to the room was through a door. A space of one inch was allowed around the room between the

bottom of the walls and the floor, for the free circulation of air from the outside. The walls of the room were supported on blocks at the four corners. The doors and windows of the larger room in which this room was placed being thrown open.

My tests were to determine the difference in heating capacity between stoves containing atmospheric burners and those containing burners for illuminating gas and copper reflectors, and an arrangement of drum through which air passed and was heated before entering the room. The form and construction of stoves tested will be seen in figs. 1, 2 and 3. (See page 394)

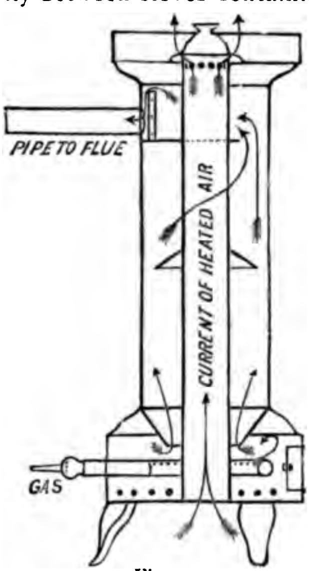

Fig. 1.

Fig. 1 shows the internal construction of the atmospheric burner stove; fig. 2, the internal construction; and fig. 3 the external form of the stove using the illuminating gas burner and reflector.

The following is the result of the tests with stoves 8 and 9 inches in diameter :

Eight-inch plain heater, atmospheric burner, connected with outside of room to carry off products of combustion—

Time.	Temp. Outside.	Temp. Inside.	Meter.
2 h	70°	71°	479 feet.
2 h. 37 m.	70°	84°	485 feet.

Time, 37 minutes; gas burned, 6 feet; increase of temperature. 13°; pressure, 1½ inches; 672 cubic feet of air heated 13°=1 cubic foot heated 8,736°.

Eight-inch reflector heater, with illuminating burner, connected with outside of room to carry off products of combustion and convey fresh air to stove—

Time.	Temp. Outside.	Temp. Inside.	Meter.
9 h. 17 m.	70°	70°	426 feet.
9 h. 55 m.	71°	91°	432 feet.

Time, 38 minutes; increase of temperature, 21°; consumption, 6 feet; pressure, 1½ inches. Fresh air admitted to room through stove, 40 cubic feet; temperature on entering stove, 70°; temperature on leaving stove, 280°. 672 cubic feet heated 21° = 1 cubic foot heated 14,112°, an increase of 5,376° per cubic foot over the preceding test=61 per cent.

Test of a 9-inch heater, with atmospheric burner, connected with outside room to carry off products of combustion—

Time.	Temp. Outside.	Temp. Inside.	Meter.
12 h. 52 m.	71°	72°	472 feet.
1 h. 28 m.	71°	84°	478 feet.

Time, 36 minutes; increase of temperature, 12°; consumption of gas, 6 feet; pressure, 1½ inches; 672 cubic feet heated 12°=1 cubic foot heated 8,064°.

Test of a 9-inch reflecting heater, with illuminating burner, connected with outside of room to carry off products of combustion and convey fresh air to stove—

Time.	Temp. Outside.	Temp. Inside.	Meter.
10 h. 28 m,	67°	70°	455 feet.
11 h. 05 m.	69°	90°	461 feet.

Time, 37 minutes; increase of temperature, 20°; consumption of gas, 6 feet; pressure, 1½ in. Fresh air admitted to room through stove, 50 cubic feet; temperature on entering stove, 67°; temperature on leaving stove, 280°. 672 cubic feet heated 20°=1 cubic foot heated 13,440°, an increase of 5,376° per cubic foot over the preceding test=66 per cent.

The stove is constructed so as to take a certain quantity of fresh air from the outside of the room by means of a pipe connected to the lower part of the stove (Fig. 2), which is conducted to an internal drum, which is heated at the bottom and side by the gas, the products of combustion from the gas being passed out of the stove through a pipe, and thence conveyed to a flue, or outside the room, thus preventing the contamination of the air, and the unpleasant odor so often noticed where gas stoves are used in close rooms. In the plain heater first tested the increase of temperature resulted almost entirely from radiation, whereas, on this stove, we also had the benefit of reflectors and convected heat. Thus it will be seen

that the 8 inch reflector showed an increase of 61 per cent and the 9 inch 66 per cent over the plain stoves of the same outside dimensions, consuming the same quantity of gas in practically the same time—the actual difference being, in each test, one minute, With an introduction of fresh air into the room through the stove after being elevated to 280°, and all the products of combustion removed from the room. *It is all wrong*, in my judgment, to undertake to put a gas stove into a close room *without providing some means of carrying off the products of combustion.* It prevents the increased use of gas heaters more than anything else you can do.

I have made some tests as to the amount of heat developed, and quantity of gas consumed, in a given time in gas cooking stoves. Time of each test, ten minutes :

Number of Stove.	Capacity of Oven. Cubic Inches.	Gas Consumed. Cubic Feet.	Temperature. Deg. F.
5	780	1.9	420
7	1122	2.3	360
8	1635	3.1	390
9	1635	3.8	480
10	3465	5.1	460
11	3153	5.7	420
12	4722 (large oven)	4.2	360
12	2016 (small oven)	3 3	360

It will be seen by examining the figures that the large stoves are more economical than the small ones. when the size of oven, quantity of gas consumed, and temperature are computed together and compared with the Nos. 5 and 7.

I will state that No 10 stoves do the cooking for the patients in the Cincinnati Hospital. When I visited that institution some time ago these stoves were cooking the food for 450 patients and their attendants.

MR. STARR—At a cost of what?

GEN. HICKENLOOPER—At a cost of 35 cents per day.

MR. GOODWIN—I will here say that Col. Jones, the Superintendent of the Hospital, made a test of the following character. The stoves were placed in the Hospital, with the un-

derstanding that they were to be tested in competition with the coal range then in use. I did not know the cost of coal used, but resolved to make the trial, with the distinct understanding that unless the gas stoves proved more economical than the range they were not to be accepted.

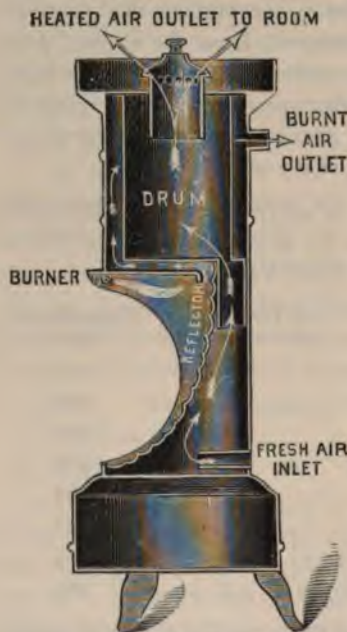

Fig. 2.

Fig. 3.

The test was as follows:

The coal used in the ranges for seven days was carefully weighed. At the end of that time the same weight of coal was placed in the retorts of the gas works and turned into gas and coke. I do not remember the figures exactly, but, whatever the amount of coal consumed in the stoves, all the cooking was done with 50 per cent of the gas made from the coal, the other 50 per cent being used for illuminating purposes; besides this they had all the coke remaining after the gas was made.

It is only necessary to say they took the stoves. [Applause.]

Another question I have frequently been asked is this: Why do you not use atmospheric burners altogether in heating the ovens, instead of illuminating gas? The same question has been considered in Europe. Having read in the London *Journal of Gas Lighting* of some tests that were made bearing on the subject, I resolved to make similar ones. For that purpose I had a box constructed of tin, of a width and length to fill a No. 7 heating oven, depth 1 inch. On the front edge were placed, at an angle of 45°, two pipes, for filling the box with water and for inserting thermometers. The first test was with an atmospheric burner placed in the roasting chamber, and the box placed about two inches below the burner. In the test the tin top of the box was left bright. Amount of gas consumed, 14½ cubic feet; time, 55 minutes, at which time the water was brought to the boiling point.

The second test was under the same conditions with an illuminating burner. Time, 55 minutes; gas consumed, 14.2 cubic feet, at which time the water reached the boiling point. I then blackened the tin, and the water was made to boil in 20½ minutes, instead of 55 minutes, with a consumption of 5.3 cubic feet in each case. The tin box being within two inches of the burner, gave every chance in favor of the atmospheric burner.

These tests were made the day before leaving for this meeting. Had time permitted, I would have placed the vessel at the usual roasting distance, in which case the result would have been largely in favor of the illuminating burner. I think this proves quite conclusively that the atmospheric burner has not the advantage over the illuminating burner, for roasting purposes, that is supposed to exist.

Some time ago I was called upon by parties engaged in the manufacture of cigars, to undertake to heat a close room, and maintain a temperature therein of about 140°, and to maintain a moisture in the room sufficient to steam tobacco placed therein. I mention this because some of you gentlemen may have manufacturers of cigars in your cities who may be disposed to try the plan, which, if adopted, helps to increase the consumption of gas.

The room was about 8 feet wide, 16 feet long, and 10 feet high. The temperature was maintained at about 150°, with sufficient moisture from the evaporating apparatus to thoroughly steam the tobacco, and prove a success.

Another party, whose factory had been destroyed by fire, called upon me for the same purpose, desiring to adopt the plan in their new factory. Their room was about 12 feet wide, 30 feet long, and 10 feet high. The apparatus was placed therein, and since that time has maintained a sufficient moisture, and a temperature of 145°, without a variation of over 2 to 3 degrees. The air is conducted to the burners in the heaters by a flue from the outside, the products of combustion being carried out of the room. A large evaporating pan is placed over the heater, and circulation maintained by a considerable quantity of pipe brought into contact with the products of cumbustion. The water is maintained at a uniform level from the outside by a suitable arrangement designed for the purpose.

Tobacco men tell me that heretofore they have had considerable trouble in maintaining the temperature to within 20 to 30 degrees of what they desired. The object is to color the leaf. Before being placed in the sweating room it is quite light and yellow; after submitting the leaf to the process it comes out a rich brown color, and looks equal to the best Havana leaf. By this means Connecticut and Pennsylvania tobacco is made to rival Havana in appearance. Gas has been called to the aid of the tobacco men, and it has proved a success.

MR. LITTLEHALES—Have you any idea of the relative cost as compared with the cost of coal that would have been necessary to have accomplished the same result?

MR. GOODWIN—The amount of gas used by the first parties was about 15 feet per hour, until the temperature desired was reached, after which the gas was lowered to probably 8 or 10 feet per hour. In the large room, two burners, of 15 feet each were placed in the heater, making a total of 30 feet per hour. After a desired temperature was reached, one of the burners was dispensed with, the other being sufficient when lowered to from 10 to 12 feet per hour.

MR. LITTLEHALES—Was the room specially constructed for the purpose of heating by gas?

MR. GOODWIN—Yes, sir; I told the parties that if they would construct the room in the way I suggested I would undertake the job. There is not the least difficulty in getting the heat up to 150°, which is all they require, and maintaining it at that point constantly.

MR. LITTLEHALES—I move that a vote of thanks be tendered Mr. Goodwin for the valuable information he has given us.

Carried.

THE PRESIDENT—The papers have all been read and discussed, and we are about through with our business, with the exception of Mr. Page's address this evening upon the subject of coal tar and its products. But before he begins his address, I believe we are to devote an hour to remarks upon members who died last year. Many of these men were distinguished in their profession, and I suppose some of the members present will desire to say something in reference to them.

MR. WOOD—It has occurred to me that it would be more satisfactory to appoint a suitable committee for the purpose of preparing, on behalf of the Association, a proper expression of our respect for the memories of these deceased members. The report of the committee can be published in our regular proceedings.

GEN. HICKENLOOPER—In the case of similar proceedings in a society with which I am connected, it has been the custom for a number of years, for the president and secretary to constitute a committee to take the course suggested by Mr. Wood. They compile a biographical sketch of the lives of the deceased members, their character and services, and present it at the next meeting.

THE SECRETARY—The object I had in view in proposing that remarks be made by the members was to avoid the stereotyped, bald and unfeeling business of resolutions. A committee is appointed, and resolutions are prepared which are the merest platitudes. I think we ought to spread upon the record,

and transmit to the families of the deceased members, a spontaneous and heartfelt expression of our respect for their memories and regret at their loss. For my own part I would rather have one such tribute paid to my memory from one who knew and loved me than volumes of resolutions. There is another view of the matter that I should like to have passed upon, and that is that when notice of the death of a member reaches the Secretary, he should be empowered to send a brief circular to each member of the Association, stating the fact that such a member has departed this life. As it is now, twelve months must elapse before, as an Association, we know that a member has passed away.

GEN. HICKENLOOPER—The object suggested by the Secretary is accomplished by the course I have suggested. In that way we avoid all this wholesale flattery, and simply make a short biographical statement of the character and services of the deceased members, expressing, at the same time, in fitting language, our appreciation of their character and services. This is preserved in an imperishable form, and can be transmitted to the family and friends of the deceased.

THE PRESIDENT—Do you make that motion?

MR. WOOD—I accept the suggestion of General Hickenlooper that a committee, consisting of the President and Secretary, be requested to prepare brief biographies of these deceased members, and cause them to be published in the forthcoming volume, and also that the Secretary notify the Association of the death of members when they occur.

Carried.

On motion, the Association then adjourned until eight P. M.

Evening Session—October 14th.

The Association met at eight P. M., pursuant to adjournment.

The President introduced Mr. Geo. Shepard Page, of New York, who delivered the following address upon

RESIDUAL RESULTS.

Mr. President, Ladies and Gentlemen :

It is needless for me to premise what I have to say by assuring you that I appreciate the honor of standing before you on this occasion. The engineer of the Marquette Gas Light Company sent a small specimen of a substance he had extracted from coal tar, supposing it to be aniline oil. The Association referred it to me to determine what it was. I think he has been, in a small way, distilling his coal tar in order to obtain the light products, and the oil to use again in enriching his gas. (Laughter.) It is evidently the light oil of coal tar, containing, perhaps, some ammoniacal liquor. Aniline oil is a very different substance. This would be worth, perhaps, ten cents per gallon; but aniline oil, used in making the best aniline dyes, such, for example, as are used in these beautiful fabrics before you, is worth about five dollars per gallon. I think, however, that this engineer located in the wilderness, as we may say, deserves great credit for investigating one of his residual products. I am sure that one beginning thus will steadily advance in the acquisition of knowledge concerning his coal tar products.

I understand the announcement was made this afternoon that I would talk to you this evening simply upon the subject of coal tar, its products and their uses. But in the invitation extended to me I was also requested to explain the value of that other residual product—ammoniacal liquor. In this connection, permit me to exhibit to you on the blackboard a drawing of the most complete apparatus for making sulphate of ammonia. After you have examined this drawing, I will show you some of the results of this process, and will exhibit to you various ammoniacal products that are found in the market.

Most of them are imported. I presume most gas engineers have seen ammoniacal liquor. (Laughter.) Here is a specimen. Perhaps the ladies would like to test the odor. (Laughter.) This was taken from the Chicago gas light works. I have not tested it; but I should judge it to be what is termed "three ounce liquor." It is not beneficial to the manufacture of sulphate of ammonia to use ammoniacal liquor of much less than eight or ten ounce strength, which is being obtained in some of our large cities by what is termed the "Mann system," or the "Tower scrubber." I presume most of you have seen it; and it is, therefore, needless for me to describe it in detail. The tower is usually filled with coke, boards or lath, scrap tin, various appliances being used to divide the current of gas passing up, and the volume of water passing down. The objection all undoubtedly find to that system is, that a portion of the gas passes up the channels gradually created without coming in contact with the water, so that the ammonia is not all taken from the gas. I presume you will all agree with me that it should be all taken out in order to get the highest illuminating power. The scrubber that is now extensively used in Europe, introduced about three years ago, is what is termed the "standard scrubber." It is a horizontal apparatus of iron, from six to nine feet in height, and four or five to six feet in diameter. A shaft run through the center, dividing it into sections of from five to ten or eleven each. On the shaft are arms carrying discs of sheet iron—forty of them on each arm. There are indentations all over these discs. This shaft revolves four or five times per minute. The gas passes in one way and the water passes in the opposite end. The water is drawn off at the other end, and the result is ammoniacal liquor of from ten to thirteen ounces. All the free ammonia is taken from the gas, and a large percentage of sulphuretted hydrogen and carbonic acid. Its cost is much less than the tower scrubber. Small works can introduce this one to advantage. I think the question of producing as much ammoniacal liquor as possible will speedily become as important to gas companies as that of receipts for coal tar; and my object in bringing this apparatus to your attention is to do what I can in

hastening the time when the largest amount can be realized from the sale of ammoniacal liquor.

Let me tell you what is done on the other side. About ten years ago I visited Dublin, and I found all the ammoniacal liquor utilized, and converted into sulphate of ammonia; and upon further investigation, I discovered that there was not a single gas company but what utilized that product in one way or another.

The process of manufacturing sulphate of ammonia, which is the chief method of utilizing the ammoniacal liquor, you will see represented on the blackboard, and I can more readily and more quickly explain it by reading a description of the drawing.

A, filtering pipes for arresting oily matters, etc., placed in a suitable position above the level of the condenser. B, closed tank containing condensing coil, N. C, boilers, with agitators, vacuum, pressure, and water gauges, safety valves, etc. D, saturators, wooden vessels lined with lead, having well for collecting and removing the sulphate; gas chamber, marked D, in which the gases given off collect and pass away by the pipe K; and draining bench, also of wood, covered with lead, and attached to the side of the saturator; E, tank for mixing the lime solution. The manipulation of the process is extremely simple. Any ordinary mechanic can make sulphate of ammonia. But one man is employed in utilizing and working up the ammoniacal liquor in the Leeds Gas Company. The ammoniacal liquor being conveyed into the filtering vessel A, it passes thence into the closed tank B, and, as required, into the boilers C, through the pipe I.

At the commencement of the operation the tank B, and one of the boilers C, are filled to their respective levels, marked and indicated by gauges on the boilers and side of condenser.

On boiling the liquor, the ammonia and other gases contained therein are disengaged, and, with a certain amount of vapor, pass up the pipe F, and through the condensing coil marked N, in the tank B. These gases and vapors in their passage give up the greater part of their heat to the liquor in the tank B, which causes a large portion of the gases contained

in such liquor to be driven off and carried by the pipe marked G into the pipe F, and there mixing with the gases which are coming from the liquor in the boiler marked C, they together pass into the saturator D.

When the whole of the gases are driven off from the liquor in the boiler (ascertained by opening the tap on the pipe F), a bushel of lime (1 bushel of lime with sufficient water added to make it about the consistency of cream), is run in and kept well mixed with the liquor by the agitator marked O. After this liming operation, which should liberate the whole of the remaining ammonia, the waste liquor in the boiler is allowed to cool, and is then discharged from the boiler by the pipe H, care being taken that the agitator is kept in motion during the time the waste liquor is being run off, so as to insure the salts of lime formed being properly discharged, and not allowed to accumulate on the bottom of the boiler. The boiler being again refilled from the tank B, by means of the pipe I, the foregoing process is repeated.

The gases from the coil N pass into the saturator D, containing strong sulphuric acid (sp. gr. 1.845), to which has been added two parts of water. The lower end of the pipe leading from the coil, and marked J, is made of lead, and reaches to within 3 inches of the inclined bottom of the vessel, its extremity having a rose, as shown. The whole of the ammonia passing into the acid is fixed, forming the sulphate, the gases liberated being carried away by the pipe K, which should not project below the underside of the top of the vessels. The salt as formed falls down the incline L into the lower parts of the saturator, from which it is occasionally removed and placed on M to drain.

The manufacture of sulphate of ammonia from gas liquor consists in submitting such liquor, freed from oily matters, to the action of heat, which expels all the free ammonia and its volatile salts, together with the other gases contained therein. When freed from these, a solution of lime is added to the remaining liquor in the boiler, for the purpose of liberating the ammonia from other salts of the body, which all ammoniacal liquor produced from the distillation of coal contains in a greater or less degree.

The general vapors given off pass forward into a vessel containing sulphuric acid, which arrests the ammonia, allowing the other gases to go forward to a furnace, to be burned or otherwise dealt with.

The apparatus required for the above should consist of a filtering vessel filled with sawdust, fine breeze, sand, or other filtering material, condenser, boiler for driving off the gases and vapors, tank in which to mix the lime, solution and saturator, to contain sulphuric acid, for arresting the ammonia and forming the sulphate.

You will thus see that the process is as simple as it could well be. It can be used in all classes of works. Let me give give you the results on the other side. In the utilization of ammoniacal liquor last year the Leeds Gas Light Company averaged for their ammoniacal liquor 75 cents per ton of coal carbonized. I believe there is no company in the United States that receives over 10 cents per ton carbonized. If the Leeds company had converted their liquor into sulphate, they would have done even better than that.

Permit me to show you some of the products of ammoniacal liquor, and to state some of the uses to which they are put. You are all familiar with aqua ammonia. Here is a specimen of it. I show a specimen of another product of ammoniacal liquor—sulphate of ammonia. That is made by the apparatus represented on the blackboard, which I have already described. The chief use of that is as a fertilizer. It contains from 25 to 27 per cent of ammonia. If the same law prevailed in the United States that exists in England, the demand for it here would take all that would be produced. The manufacturers of American fertilizers do not put enough ammonia in them. State inspectors by-and-by will remedy this.

But another important use of this product is in making alum. Alum from sulphate of ammonia is made more cheaply than in any other way. I show you a specimen of ammonia alum. It is made on an extensive scale in England. That industry will soon be established in the United States. Here is muriate of ammonia, another important product. All of these specimens are from the stock of Messrs. Fuller & Fuller, the largest

chemical house in the west, and one of the largest in the world. They told me to-day that the larger part of their stock of these ammonia products, all in constant demand, come from the ammoniacal liquor of European gas companies. Here is the carbonate of ammonia. It is an ingredient in the Royal Baking Powder, and is used by all baking powder manufacturers. Those of you who are familiar with the growth of this business during the past five or six years, can form an idea as to whether or not the demand for that article is likely to be diminished. This specimen is muriate of ammonia—these beautiful crystals. Aromatic spirits of ammonia is familiar to most of you.

These specimens that I now show you are iron and ammonia, ammoniated copper, and bromide of ammonium. There are many others here, but I will not take the time to enumerate them. It is unnecessary for me to go further. You see that there is a market at home for your ammoniacal liquor whenever you make it of marketable strength.

As I am expected to say something upon the products of coal tar, it may be proper for me to tell you how my attention was first called to the subject. While living in Boston, twenty-four years ago, I read this item in the *Annual of Science*, edited by the late Prof. Pierce, of Harvard: "The wonders of chemistry. Ten processes from coal producing a substance worth its weight in gold." The ten processes were then given—coal, coal tar, crude light oil, crude benzole, refined benzole, nitrobenzole, crude aniline, aniline oil, rose-aniline, magenta, the latter being worth $323 a pound. The item closed thus: "The diamond is to come." That never faded from my mind. The next time my attention was called to the value of coal tar was two years later, in Salem, Mass. I saw a workman heating a black substance in an iron kettle on the street. I asked him what it was, and he said it came from coal tar. I asked him how it was made. He said, he did not know. I found that it was coal tar pitch, made by destructive distillation. The following year my interest in the coal tar was aroused at the exhibition of the mechanics' Charitable Association, of Boston. In an exhibit of chemicals were some

coal tar products. One of them was a substance many of you have seen—the oil of myrbane, sometimes called from its odor, though incorrectly, artificial oil of bitter almonds. I could not help thinking what a wonderful substance this coal tar must be, yielding the beautiful and valuable coloring material, the exquisite perfume, and the useful pitch ; and from that time I have been constantly identified in making, what was then a waste, product of value.

Now, as to the processes and products We have here a coal familiar to western gas makers, Youghiogheny, and this other specimen from Erie. From every ton of these coals carbonized there is deposited in your hydraulic mains a substance called coal tar. The hydrocarbon, being heavy, falls to the bottom, and is constantly running away to your tar tanks. That is the substance you see here—black, always black ; sticky, always sticky ; a bad odor, always a bad odor. Gas men get rid of it in various ways. Some burn it. That is a terrible waste of coal tar (laughter), as I think I shall be able to show by the facts and figures presented for your consideration. The business of distilling coal tar is conducted in this country, with the exception of one or two companies, in a very crude way. The vapor given off is passed through a pipe in a condensing tank, and the first liquid condensed is this. It is called the light oil of coal tar, because it is lighter than water As the heat gets higher, the distillate becomes heavier than water, termed in this country the heavy or dead oil. The English term is more accurately creosote oil. One or two firms carry the distillation still further. They run the heats still higher, and obtain this substance—anthracene oil. After the anthracene oil is taken out, then there is left what is called hard or fuel pitch. Ordinarily, however, the distillation is carried simply to the point of making and leaving a pitch, such as you have seen just opposite the hotel in filling in between the paving blocks around the post office. The ordinary process of distillation of coal tar in the United States creates but those three products, light oil, heavy, or creosote oil, and pitch, the respective values of which are as follows :

Light oil, 15 cents per gallon ; heavy oil, from five to seven

cents per gallon ; and the pitch from five to seven cents per gallon. These are not large values, it is true, and hence the tar distiller in most of our cities cannot afford to pay over twenty cents per ton for coal tar. But if the heat is carried to 500° F., greenish crystals form thickly upon the surface of the tar distillate—"green grease" we call it. This is passed through woolen filters, and then subjected to hydraulic pressure, the resultant being this substance—anthracene of 50 per cent purity. One of the most interesting discoveries in practical chemistry was that of anthracene, followed by one later, which gave great value to this—alizarine, or artificial madder. I have only to call your attention to this elegant Turkey-red fabric from the famous looms of Garner & Co., Cohoes, N. Y., to these woolens, to this yarn, to these prints, and you witness its varied uses. For years, and, indeed, for centuries, the sole source of alzarine was the madder root grown in Holland, France, Turkey, Russia and Syria, and it required three years or more to gather from the ground the coloring matter which was taken out by chemical process. But this substance, anthracene, is found to yield the identical compound. The same chemical elements can be taken from anthracene and put together cheaper by chemical process than they can be extracted from the madder root. Alizarine was discovered, in 1869, by the distinguised chemists Graebe and Liebermann, of Berlin. I have here one of the earliest specimens of commercial anthracene, which was obtained by me in Glasgow, in 1870. At that time it was worth only $100 a ton. In two years, so rapid had been the advances in the practical chemistry of converting anthracene into alizarine, that its value rose to $2,500 a ton. Since that time the agricultural madder-growing industry has disappeared, and the chemist produces a better and cheaper substance from worthless coal tar for dying the world's fabrics Turkey-red.

To return to this chemical aniline. It was discovered by W. H. Perkin, in 1855. I have the honor of numbering him among my correspondents. I have here a history of the coal tar dyes that he was kind enough recently to send me, which was read before the Society of Arts, in London. Let me, at this point, inform you how he made the wonderful discovery

of the aniline dyes. The Peruvian or chinchona bark trees in Peru and in the East Indies, it was thought, were dying out. The physicians of London went to Hoffman, a great chemist of that city, and requested him to endeavor to make quinine artificially. He knew that the elements of quinine were lodged in coal tar. He began the work of separating them. He employed the services of one of his brightest pupils, Perkin. The latter carried the process on from the light oil to the benzole, from the benzole to the nitrobenzole to the aniline oil, and then, putting in a certain chemical, suddenly a gorgeous red color was produced. You remember it was called "Magenta," and the second dye "Solferino," the battles having just been fought. This was in 1855 That was the brilliant discovery that led to this magnificent result (pointing to the silks, satins, worsteds, etc., exhibited on the stage). He at once stopped searching for quinine, and immediately began the erection of works. I show you here an engraving of the works erected by him. In 1858 they had grown to the size shown on the upper part of the page. In 1870 he began making alizarine. His works grew until, in 1873, they covered ten acres, as illustrated in this second engraving. You will appreciate the marvellous growth of this industry when I tell you that in 1873, seventeen years after his accidental discovery of aniline, he sold these works, receiving a check for $750,000. In the meantime he had accumulated a vast fortune. Our water gas friends say they do not want this vile residual, and do not make it in their process. [Laughter.]

In this same book Mr. Perkin gives the following figures of the sales of aniline and alizarine dyes in 1878: Germany, £2,000,000, or $10,000,000; England, £450,000; France, £350,000; Europe, £350,000; total, £3,150,000, or, in round numbers, $15,750,000.

Is it not humiliating that the United States is of necessity omitted from this roll of honor.

You could not get any such figures from water gas residuals. [Laughter.] It seems to me, gentlemen, if there is nothing else that stands out prominently before you as affording a hopeful outlook for the industry you represent, these figures

alone would be sufficient to give you courage, if you had need of it. [Applause.]

I have told you that the light oil produces benzole, and that it is not only used in making aniline dyes, but it is also required in photographic chemicals, and for many other purposes. It finds a ready sale at from 65 cents to $1.50 a gallon. If not sold as benzole, it is converted into oil of myrbane, or nitrobenzole One house in Chicago buys this material in quantities of from ten to twenty thousand pounds, at a cost of about 30 cents a pound. A New York manufacturer and other dealers also buy to an equal extent. Whiskey makers use it to give the smoky flavor to "Genuine Irish Whiskey" made in Kentucky; and lager beer brewers use it to "age" their beer. notwithstanding it is a deadly poison. This need not alarm you, as it is a well known fact that the gas fraternity is strictly temperate.

There is a market for every pound that is made here. The bulk of the trade is supplied by foreign importation, as only one American firm produces oil of myrbane.

We return again to these aniline crystals from nitrobenzole, which Perkin made in 1855. They were then worth $323 a pound, but by increased facilities for manufacturing, by cheapening the chemicals, and by improved processes, they are now sold at from $3.50 to $10 a pound. The light oil also yields naphtha, toluol, and zylol. Then there is left a thick substance, which, after passing through various processes, is converted into this pure white, solid crystal, carbolic acid, a substance familiar to all of you. It is used to a large extent in medicine and surgery, and in the mechanical arts, and the demand is rapidly increasing each year. There is produced in this country annually about 50,000 pounds of crystallized carbonic acid, and about 150,000 pounds of liquids; and yet, from across the water, comes every year an exceedingly greater quantity. From carbolic acid is made that very useful product, salicylic acid. Those of you who have suffered from rheumatism have undoubtedly had it administered to you. Of course, no member of this Association ever had the gout. [Laughter.] Should any gas engineer find time to have it he

will probably experience relief by taking salicylic acid. It is also extensively used by beer brewers and wine makers to check fermentation. Here is another product from carbolic acid, picric acid. Among other purposes this is used for making a powerful explosive. Its chief use, however, is as an orange dye. The beautiful yellow and orange mats are dyed with it.

We return to the heavy or creosote oil. It contains a substance called cresylic acid, somewhat similar to carbolic acid, except that it does not crystalize. This is sold to druggists, and by them to dentists, who use it in place of wood creosote. It is used for various purposes in the mechanical arts. This beautiful liquid, cresolene, is also obtained from the creosote oil. It was discovered by a French chemist, in 1865, that hydrocarbon deposited in the bottom of your purifying boxes gives off a vapor, when the boxes are open, that has a curative effect upon the zymotic or germ-produced diseases, as whooping-cough, asthma, scarlet fever, diphtheria, etc. You have doubtless frequently admitted to your purifying room persons suffering with some of these diseases, particularly whooping-cough; and you probably know of many cures having been effected. The agent performing the cure is cresolene. In 1877 an American chemist whose child was suffering from whooping-cough, and too sick to be taken to the gas works, conceived the bright idea of taking the gas works to the child. He procured from the purifying box of the gas works the condensed hydrocarbon and vaporized it for a few nights in the sick room, and the child was cured. Cresolene is now being sold by druggists for that purpose. I have personal knowledge of over three hundred cures of whooping-cough effected by the use of cresolene, vaporized in this little apparatus I hold in my hand. The gas profession is not only a benefactor to mankind, in producing materials from which these beautiful colors are obtained, but also in affording to suffering humanity the relief that is obtained by the use of carbolic acid, salicylic acid, creosote and cresolene.

The chief use of crude creosote oil is as a preserver of wood. It is used not only to preserve wood from decay, but in the case of piles in docks and bridges from the attack of the *teredo*

navalis, or marine worm, in salt water, which often cuts off an unprotected oak, spruce or yellow pine pile, two feet in diameter, in three or four months. This process has been in general use in England during the past forty-two years. Nearly every railroad tie and bridge timber is creosoted. I exhibit you a photograph of a *teredo navalis* that, in two years, grew to the length of 18 inches. It came from the Gulf of Mexico, near Pascagoula. I show you also a section of yellow pine timber. That dark space you observe was creosoted. The *teredo* excavated the wood in every part except where creosoted. All the piling of the bridges of the Mobile and New Orleans Railroad is creosoted, they having erected large creosoting works at Pascagoula. Other railroad companies have also taken advantage of it, viz.: the Houston and Texas Central, the Louisville and Nashville, the Old Colony and Eastern Railroads of Massachusetts. There are several other works in operation for creosoting timber in Boston and New York; but this important industry can scarcely be said to have begun. Wherever this creosote oil is produced in sufficiently large quantities, say, in Chicago, St. Louis and Cincinnati, creosoting works will be erected for the preservation of wooden pavements that now only last from a year and a half to three years; and for the preservation of railroad ties, the life of which averages about three years, and involves an annual outlay of about $600 per mile for renewal, I will mention an incident which will serve to show in what direction the current is setting. As I crossed the Hoboken ferry, to take the train on my way to Chicago, immense piles were being driven for the foundation of the buildings of the Hoboken ferry houses, and these piles were all creosoted. (Applause). Whenever you look at a paper or book you see coal tar on it. Creosote oil is burned in a peculiar furnace which permits the smoke to be condensed in a large closed apartment. It falls, like black snow, upon the floor, and is gathered and ground with linseed oil, producing printer's ink. So you see that even the press is dependent upon coal tar! (Applause.)

There is another product from coal tar, which the ordinary coal tar distiller dislikes to see. Gas engineers also dislike to

see it. That product is naphthaline. But naphthaline is to-day the most interesting of all the long list of remarkable products of coal tar. These brilliant, fast colors, more glorious than the aniline dyes, are being produced from this naphthaline. One of our most distinguished chemists says that, from present indications, the time will come when it will pay to run gas works to *make naphthaline, selling gas as a bye-product!* (Applause.) The rich gold colors the ladies are wearing are produced from naphthaline. You see some of them here. There has never been anything created by the art of man so beautiful as the colors that are abstracted by the chemist from naphthaline. These colors are fast. In that fact lies their chief value. Aniline colors are often evanescent; but, although they fade, they fade all over alike. The ladies are learning to use aniline dyes when a silk dress becomes faded. Many of the ladies are producing at home nearly as beautiful effects on old silks, in re-dyeing them, as the dyers at Paterson can produce.

Let us proceed a step further. We have this substance that I now show you, pitch. It is used for many purposes ; in making gravel roofs, in the wooden pavements in the streets of our cities, for lining the inside of powder kegs. No moisture can pass through it. It is also being largely used in the construction of vaults, the bricks being dipped into it, so that the vault is kept free from dampness. I believe the time is coming when cesspools, reservoirs and sewers will be constructed in this way, so that our houses will be made proof against filtration from sewers and cesspools, and our homes escape contamination. It costs but little more than the ordinary method of building with cement. The source of probably one-third of the ills which flesh is air to, especially in the country and villages, would be obviated by this simple expedient. Dr. Chandler, President of the New York Board of Health, recently made this statement to me.

We now come to the hard pitch. When the company with which I have been identified commenced manufacturing anthracene, we accumulated the hard pitch—tons upon tons of it. There was no use for it, but we adopted a plan by which

every ton was eventually utilized. And for what? Why, we mixed 10 per cent of this material with 90 per cent of anthracite coal dust, and manufactured a fuel to be used upon locomotives. Here is a specimen brick. [Applause.]

Here is a method, and a profitable one, too, of not only utilizing this hard pitch, but also of utilizing the dust of anthracite and bituminous coal. That is a very important consideration. Every fourth ton of anthracite coal is converted into dust, and five million tons are annually wasted in this way. The industry is yet in its infancy, although the fuel is being used upon several railroads in the east, and the works of the Anthracite Fuel Company, at Rondout, N. Y., which some of you have doubtless seen, have turned out 150,000 tons of this artificial fuel. You all know the vast quantity of bituminous coal that railroad companies and other industries use, and you can form some judgment of the enormous loss there must be from the now valueless dust. Coal tar pitch alone furnishes a medium by which this waste coal can be made of value.

When the distillation of the tar is carried to the final point, two other substances are obtained, one called pyrene, the other chrysene. This last is perfectly white. Then is left this coke. Even the electric light yonder pays tribute to coal tar, its carbon points being largely composed of this coke, which is 97 per cent carbon. I do not know whether it is policy to produce a substance that furnishes carbon points for electric lights.

We come back again to anthracene and its derivatives. I show you this brown liquid paste, the commercial product "ten per cent alizarine." This phial contains the pure, brilliant red, needle shaped crystals. How beautiful they are. But alizarine is not sold in that form to dyers, but in a paste, which is imported from England and Germany in barrels, $2,000,000 worth each year, and $5,000,000 of the aniline crystals. Think of it! Seven million dollars paid by our manufacturers for these two coal tar products!

It seems to me, gentlemen, that it is a reflection upon the intelligence of our chemists, that they did not do years ago

what must first be done before these substances can be produced here, and that is to call the attention of your profession to the rapid growth and immense value of the industry, and to show you how your coal tar and other crude products can be profitably utilized. But the coal tar industry cannot be profitably carried on until the coal tar produced at the great centres, and within a radius of 100 or 150 miles of them, is gathered at a certain point within that radius, and utilized under the direction of skillful chemists. A great quantity of coal tar must be gathered together before these products, the bases of aniline and alizarine can be profitably extracted. How much anthracene do you suppose there is in coal tar? But one per cent, and practically but one-half per cent is obtained. When I tell you that one house has received for that one-half per cent, in eight years, obtained from the coal tar produced by ten gas companies, $500,000, do I not offer a powerful argument in favor of urging forward the agglomeration of the coal tar, so that it will pay to take out anthracene in sufficiently large quantities to make the industry a profitable one?

About 3 per cent of benzole and 2 per cent of carbolic acid can be produced from coal tar. By having coal tar gathered together in large quantities, these, and the other substances I have shown you, can be profitably extracted, but not otherwise. I have collected estimates, easily verified, based on practical experience, showing that 5 to 7 per cent of fine products, from, say, 4,000,000 gallons of coal tar, yields $170,000, while the immensely larger proportion of from 93 to 95 per cent yields but $200,000. If this industry is thus established, in due time American chemists can supply the manufacturers of these magniocent silk, woollen, cotton, and leather goods throughout the country with aniline and alizarine dyes, for which such an immense sum is now paid to foreign manufacturers of these products. We can place our manufacturers on a level with those of Manchester and Lyons, who are now obtaining these dyes at one-half the prices paid for them in the United States. On an importation of $7,000,000, our manufacturers are paying a duty of over $2,000,000—35 per cent *ad valorem*, or 50 cents per pound. I ask you, gentlemen, if

you know of any industry more worthy of being established here, or one that offers a more brilliant future than this? [Applause.]

One of the most beautiful substances obtained from coal tar is uranine. The smallest particle will color a large volume of water or alcohol, as you see by this experiment. Before I go further, permit me to call your attention to these leather goods of different colors, all of which are produced from aniline dyes. Wherever you see leather with these bright colors, you may know they are from aniline. Indeed, it can almost be said of all colored fabrics that the dyes are from coal tar.

I come now to the practical part of my remarks. I do not appear before you simply to exhibit what you can observe in the windows of any large drygoods store. I come here to explain to you practical plans for obtaining more money from your coal tar and your ammoniacal liquor. Assume that within a circuit of 150 to 250 miles of the cities of Chicago, St. Louis and Cincinnati there would be a carbonization of, say, from 200,000 to 250,000 tons. Then you have the following figures:

265,000 tons coal, at 15.1 gallons per ton, yield 4.000,000 gallons coal tar. The products are:

2,400,000 gals.	pitch, at 3 cents	$72,000
1,000,000 gals.	creosote oil, at 5 cents	50,000
20,000 gals.	benzole, at 75 cents	15,000
20,000 gals.	naphtha, at 50 cents	10,000
20,000 gals.	black varnish, at 25 cents	5,000
5,000 gals.	carbolic acid, 95 per cent, at $1.50	7,500
7,500 gals.	" 85 " at $1.00	7,500
10,000 gals.	" 75 " at 75 cents	7,500
3,333 gals.	(30,000 lbs.) carbolic acid crystals, at 40c.	12,000
20,000 gals.	(200,000 lbs.) anthracene, 50 p. ct., at 40c.	80,000
6,667 gals.	(60,000 lbs.) oil myrbane, at 30 cents	18,000
2,777 gals.	(25,000 lbs.) creosote, at 40 cents	10,000
150,000 gals	(1,500 tons) tarred felt, at $50	75,000
3,665,277 gals.	Total	$367,500

Value of coarse products	$200,000
Value of fine products	167,500
Total	$367,500

The prices I have given here are fair market prices for the chemical products named.

Expense of Working 4,000,000 *Gals. of Coal Tar.*

Labor—40 men at $2 per day, for 300 days	$24,000
Factory expense	10,000
Fuel	10,000
Transportation	15,000
Expense account	3,000
Interest, taxes, insurance	10,000
Repairs	5,000
Superintendence	5,000
Chemicals	10,000
Dry felt, 750 tons, at $80	60,000
Total	$152,000

The agent of one of the largest railroads in the country says that his company will transport the coal tar in tanks, as oil is transported, at the rate of $2 per ton for 150 miles or under, taking the loaded cars to the point desired and hauling the empty cars back, so that the cost for 150 miles for transportation will not be over 40 cents per barrel.

Cost of Plant to Work 4,000,000 *Gals. Coal Tar.*

Ground, 60 acres	$5.000
Tar stills, 50 bbls. each, at $500	5,000
Fitting stills, at $250	2,500
Pipe and connections, condensers	2,500
* Tar tankage, 20,000 bbls	2,500
* Oil tankage, 5,000 bbls	500
Benzole and naphtha apparatus	2,500
Oil of myrbane apparatus	2,500
Carbolic acid and creosote apparatus	5,000
Anthracene apparatus	5,000
Four saturating machines, at $625	2,500
Lumber, incidentals, labor	5,000
Four tank cars, tank barge	9,500
Total	$50,000

* Tar and oil tankage is created at this low cost by using condemned canal boats and barges.

As shown by these figures, we have a margin of not less than $200,000.

In regard to the utilization of the ammoniacal liquor, I submit the following figures:

Plant	$25,000
Labor, sulphuric acid, lime, fuel, transportation, repairs, interest, insurance, taxes, superintendent, per annum	50,000
Product, 7,950,000 gallons 10-ounce liquor yields 5,300,000 pounds sulphate, at 4 cents ...	212,000

Profit, $172,000, or 65 cents per ton of coal.

In conclusion, let me show you the actual results in money value to be obtained from these residual products by the gas companies of the United States. I think most of those present who have given the subject consideration, will agree with me that the gross carbonization of coal is about one million of tons annually. This would yield of sulphate of ammonia, twenty millions pounds, having a value of $800,000. The present receipts, carefully estimated, are $63,400. Here is a deficiency, in this one residual, of $736,600.

The coal tar product is about fifteen millions of gallons, which, according to the results I have read to you, ought to yield the gas companies of the United States $1,120,000. The present receipts do not exceed $200,000, or an average of 20 cents per ton of coal carbonized, leaving a deficit of $920,000, which, added to the deficiency in the receipts from ammoniacal liquor, makes a total of $1,656,000. These figures must prove to be an incentive to you to bring about the utilization of these two residual products in a manner that will yield the largest results. You certainly have no cause for discouragement, even though inventors and capital are seeking to introduce other processes of producing light. You hail the advent of the steam stoker which never strikes, and that costs so much less than manual labor, and performs its work so economically and satisfactorily. New fields for the introduction of gas are opening upon every hand. Gas heating stoves, gas cooking stoves, gas engines and gas furnaces will speedily win their way to popular favor. Do not be handicapped by unsound notions

of economy; but if, when you are convinced that it is economy to use the steam stoker, and that these results can be obtained from your residual products, you go forward with unhesitating steps—there is no department of trade in the country to-day that has a more bright and promising future than yours. This is the earnest conviction of one who has been identified with your industry for 21 years, who has paid to gas companies for coal tar, in that time, over $1,300,000, and who looks forward to 21 years more of active, and, I trust, profitable labor in the same field.

I thank you, ladies and gentlemen, for the patient and courteous attention with which you have listened to me. If I have given you any information that is interesting and valuable, and from which good will result, I shall be highly gratified; but, be that as it may, it has given me sincere pleasure to have had the privilege of addressing you. (Applause.)

THE SECRETARY—I move, Mr. President, that the thanks of this Association be most heartily tendered to Mr. Page for the unusually interesting and instructive, not paper, certainly, but lecture that he has favored us with.

THE PRESIDENT—It gives me great pleasure to put this motion, for I am sure that every member of the Association who has heard Mr. Page appreciates most thoroughly the valuable and interesting information he has given us

The motion of the Secretary was unanimously carried.

MR. PAGE—Permit me, Mr. President, to move a vote of thanks to the house of Field, Leiter & Co., of this great Northwestern Metropolis, who have kindly furnished many of the materials for this beautiful exhibit. Mr. Higginbotham, of that house, directed me to go through their stock, and to select whatever I wanted, and that whatever I desired for my purpose should be sent here. I would also move that a vote of thanks be extended to the house of Fuller & Fuller, who likewise most courteously said to me that whatever I desired to bring here was at my service, and we are indebted to their kindness for most of these beautiful ammonia products to which I have called your attention.

Carried.

MR. PAGE—I intended to state that I should be glad to answer any questions that the members of the Association desire to ask. It is possible that I may not have made myself perfectly understood upon some points; and, if so, I shall be pleased to make any explanation or give any further information that may be called for.

MR. HELME—I should like to inquire if the coal dust composition making the fuel bricks that he referred to is anthracite coal or bituminous coal?

MR. PAGE—The Anthracite Fuel Company now use a mixture of anthracite and bituminous. The works are located at the farthest point north at which they can get the benefit of cheap transportation by water and reach those northern coal burning railroads. You will understand that the only use that is made of these bricks is for fuel for locomotives. Several of these northern roads, the Renssalaer and Saratoga, the Albany and Susquehanna, the Walkill Valley and others, use this artificial fuel.

MR. HELME—At what price can it be sold per ton?

MR. PAGE—I think, at $3.50 per ton.

MR. HELME—Will it do as much service per ton as anthracite coal?

MR. PAGE—From 11 to 14 per cent better results are obtained; 5,000,000 tons of this product, requiring 500,000 tons of pitch, will be made this year in Europe. The Paris Gas Light Company, one of the largest in the world, and the Chartered Gas Light Company, of London, sell their entire pitch production for artificial fuel from waste coal dust. This industry would, perhaps, follow the establishment of these large coal tar operations at a common centre like Chicago, Cincinnati, or St. Louis. For instance, waste breeze and waste bituminous coal can be gathered in the same way that the coal tar is, and mixed with the pitch that will be produced, and this fuel, manufactured just as it is by the Paris Gas Light Company. The two things could be worked together very advantageously.

GEN. HICKENLOOPER—I would ask Mr. Page if he would be willing to take the leadership in this matter.

Mr. Page—I have had correspondence and personal interviews with foreign chemists with reference to the best and cheapest way of producing carbolic acid, cresylic acid, salicylic acid, oil of myrbane, anthracene, and all these different products, upon which this industry depends largely, on the other side. American chemists have not been educated practically, and there seems to be a lack of experience among them in this direction. But on the other side there are numbers of men employed in these great chemical works, who have for years been making these products, and who are obtaining but small salaries. I have in mind a man employed in one of these houses who is the manager of the concern, having created a business which extends to China, Japan, and North and South America, and who received but $500 per annum. Such men will come here very quickly for $1,000 to $1,500 a year. I will say, further, that, while not binding myself to superintend any such company or undertaking, yet, whatever time and assistance I could give would be devoted to the enterprise if desired.

Mr. Helme—It strikes me that it is really worthy our attention. Undoubtedly, in looking carefully into the matter, we may find many difficulties to contend with. We could afford to lose a little money in developing this business. We could form a company and put it under the charge of some person from the other side, as Mr. Page speaks of, and if we lost money for a few years, we should very soon get it back if the business was a success. Besides, we should then be able to sell our gas for something nearer the price that they sell it for on the other side. We all know that in many instances gas is sold over there for absolutely less than it costs us to put it into our holders, and the fact that they are able to utilize their residuals to such an advantage, is probably the principal reason that they can afford to sell their gas so cheap.

Major Dresser—I had a conversation with Mr. Arson, the chief engineer of the Paris Gas Works, and I asked him that question. I said to him that a Yankee gas man would like to know, if he did not mind telling. how much it cost him to put his gas into the holder. He smiled, and said that they did not

figure it in that way. He said, "The truth is, our residual products pay all the expense of making our gas, and our only expense is in distributing it." That shows whether this industry spoken of here will pay. It would be an experiment to start such an operation here simply as regards the locality, but not as regards the facts in the case. It has been done by the Paris Company for years, and two years ago the Chartered Company, of London, erected large works at Beckton for carrying on the same operation. They were forced to it, begging Mr. Page's pardon for reflecting upon that noble fraternity of coal tar men, because the coal tar men got up a corner on them, and the coal tar men are left out in the cold now. The Chartered Company is carrying on the operations on a very large scale, and it is deriving a very large profit from them. So far as the success of the thing is concerned, it may be considered as already established. It only remains for us to put forth that energy that we generally put into anything we take hold of, guided by practical common sense, to make it a success here, and remove from our profession in this country those insinuations, that I must say are justly deserved, of throwing away what ought to pay the expense of making our gas.

MR. HELME—In his strictures upon us Mr. Page must bear in mind that it has not been a great many years since this color business was started, or, at least, assumed anything like its present proportions. I understand that the demand has increased.

MR. PAGE—Very rapidly; probably to the extent of from a half a million to a million of dollars a year.

MR. HELME—The fact that the demand for these colors has increased and is increasing so rapidly is really an encouragement for us to move in the matter.

MR. PAGE—Not only the manufacturers of silk, but the manufacturers of carpets, of cotton goods, of wall paper, of fancy leather goods, and many others, use these colors from coal tar products. I do not wish to be understood that I have reflected at all upon the low price paid for coal tar by the coal tar distillers of the United States. Nearly all of them distil but

the three products, light oil, heavy oil, and pitch, and they cannot afford to pay but little more, if any, than they are paying now. I confirm what Major Dresser has said about the Chartered Company. Messrs. Burt, Boulton & Haywood, the most extensive coal tar distillers in the world, had a contract with the Charter and the Phœnix Companies for an amount per annum of 15,000,000 gallons of coal tar, and are making these finer products. They bought the Perkins color works, at a cost of $750,000. It is reported by the best chemical houses in London that they have made in the past seven or eight years not less than $10,000,000. They were not willing to divide fairly with the Chartered Company, and the Chartered Company was not to blame for refusing to renew the contract, and erecting works for utilizing their residuals themselves, and realizing the profits. Their production during this year will be 500 tons of anthracene which they will sell for $400,000. Mr. Butterworth has asked me what the sulphate of ammonia apparatus, placed upon the blackboard by my friend Mr. Hersey, of London, costs The cost of an apparatus for works carbonizing, say, 10,000 tons, would be about $3,000. The expense would be somewhat less for works carbonizing a smaller quantity of coal. It is not necessary to run them every day; they can run for a week or two, and then shut down again.

MR. FORSTALL—As we are now assembled for the last time, I think it would be proper to testify to the Chicago Gas Light and Coke Company our appreciation of the reception it has tendered us to-morrow, and the elaborate programme that has been prepared for our enjoyment. I would, therefore move a vote of thanks to that Company and to its President, Mr. Watkins, for the hospitality, courtesy, and kindness extended to us at his hands.

Carried with applause.

THE SECRETARY—There being no further business before the Association, I move you, sir, that it now adjourn *sine die*.

THE PRESIDENT—Before putting the motion to adjourn *sine die*, permit me to express my gratification, in which I hope you are able to join, at the success of our eighth annual meet-

ing. While it is true, that unfortunately, several of our Eastern brethren have not been able to be present, whom we always miss when they are absent, yet, on the whole, this meeting has been a very enjoyable and a very profitable one. The papers, that have been prepared with great detail, and with elaborate care, and the discussions upon them, have been very interesting, practical, and instructive. Now we are about to separate. We have heard since we met here that several of our members who were with us last year are no more. It is not at all likely that we shall all meet again precisely as we are now. It is probable that, when next October comes round, some of us will have been laid away in the grave. Let us not forget that. I wish you all a most happy return to your homes, and that as many of us as Providence will permit, may meet next October, in the City of Boston, and that we may have a better meeting than we have had on this occasion, if that is possible. [Applause.]

The Association then adjourned *sine die*.

In Memoriam.

WM. B. CLELAND,

Supt. Gas Light Co., Vicksburg, Miss.

DIED OCTOBER 15, 1878.

LAZ. NOBLE,

Sec. Citizens Gas Light Co., Vincennes, Ind.

DIED OCTOBER 18, 1879.

GEORGE BUIST,

Manager Gas Light Co., Halifax, N. S.

DIED NOVEMBER 2, 1879.

OLIVER G. STEELE,

Manager Gas Light Co., Buffalo, N. Y.

DIED DECEMBER 10, 1879.

GEORGE W. EDGE,

Eng'r Gas Light Co, Jersey City, N. J.

DIED JANUARY 1, 1880.

KERR MURRAY,

Constructing Engineer. Ft. Wayne, Ind.

DIED MAY 6, 1880.

JNO. O. BUXTON,

Treas. Gas Light Co., Springfield, Ohio.

DIED JULY 20, 1880.

REQUIESCANT IN PACE.

Report of Committee on Deceased Members.

Gentlemen :

The ceaseless round of Time again bringing us to the period of our annual gathering, we miss from among our number the familiar faces of some whom we have been accustomed to greet, whose interest in the advancement of our common calling and in this Association has been of long standing, and to whom we have been indebted for trusty counsel and advice.

The past year presents a saddening record of lives that have faded out from our membership, reminding us who survive that no ties of friendship serve to stay the inexorble hand of death. Here, as elsewhere, go on those constant silent changes that are incident to all human institutions, and mark the coming and passing away of man, replacing the old with the new, until the forms and faces that to-day surround us perish out of sight forever. Therefore is it that we place before you the solemn record of the dead. Since our proceedings have a measurably longer existence than the individual, it is fitting that we inscribe therein the names of those of our fellow-members who have followed the beckoning hand of death

"To silence from the paths of men."

Six of our members have died since we last met in annual convention. Some of them aged and infirm—ripened as it were by time and experience for the harvester; others have passed out from the summer of their years, in the strength of manhood and pride of purpose. Yet the messenger came to them all alike, finding their hands on the plow, following the furrow of usefulness.

When such lives, so full of honor and useful effort, are ended, may we not justly feel that it is not so much a time for tears as for admiration of their zealous, honest devotion to the large interests confided to their care, and for making resolutions to keep green and fruitful in our memories the example of worthy men.

We present such sketches of the lives of our dead as opportunity has permitted.

Wm. H. Price,
Wm. Henry White,
Committee.

GENERAL LAZ NOBLE

was born Dec. 29, 1823, at Bridgeport, Indiana. He was admitted to the bar as an attorney in 1854 and became an active politician. During the war he moved to Indianapolis, and was Adjutant-General under Governor O. P. Morton. At the close of Morton's term as Governor Gen. Noble was elected Clerk of the Supreme Court of Indiana, where he served five years. At the conclusion of this term of office, he moved to Vincennes—this was in the spring of 1869. About the year 1873 the Vincennes Gas Works, erected in 1855, passed into the hands of J. A. Daugherty, Esq., an eccentric gentleman, who almost immediately entered into a vigorous warfare with the City Council, resulting in a complete withdrawal of the city patronage. The city remained in this state of darkness for two winters, with no change or prospect of any. At this juncture, in 1876, a few enterprising citizens, with Gen. Noble at their head, organized the Citizens Gas Light Company, and after obtaining an ordinance, laid their mains and erected the present works. In 1879, nearly three years after the commencement of the works, Gen. Noble visited Alpine, Col., and while there was taken sick, and after a short illness, died Oct. 18, 1879, aged 56 years.

Gen. Noble was a man of rare business qualities, and a man of great influence in the community. He was never proficient in the technique of gas making, but was invaluable in the organization of the company, securing a very favorable ordinance from the city, and by judicious management, enlisting the co-operation of the citizens insomuch that in a few years the old works were forced to close up, and were bought by the present company.

GEORGE BUIST

was for many years the manager of the Halifax Gas Company, Nova Scotia, in which city he departed this life, Nov. 2, 1879, in the 60th year of his age, and in the apparent prime of his usefulness. His reputation as a careful, thorough engineer was established in Scotland before coming to this country, yet his efforts for his company here greatly added to his reputation,

since under his management it passed into a period of successful, prosperous business. Mr. Buist was a gentleman of much originality of thought and method; imbued with the conservatism of the old Scotch school of gas making, he was still awake to the changing phases of his profession, and promptly placed himself in position to learn the newest developments in the science of gas production.

He was of genial, hearty habit, and was unostentatiously identified with the charitable and religious interests of his adopted home, leaving among his fellows the memory of a large-hearted, clear-minded and thoroughly honest man. His death has removed from the Association one of its sound, practical members, and as such the loss will long be felt by all who suffer from his untimely end.

OLIVER G. STEELE, OF BUFFALO, N. Y.

Another of the pioneers in the manufacture of illuminating gas has passed away, leaving behind him a bright and shining name, a memory that may well be cherished by all, and an example that is fit to be followed by men in every walk of life. His loss will be most severely felt by those more immediately associated with him in business, in good works, and in both the public and the private relations of life which existed to so wide an extent in the locality where he dwelt.

So far as the gas interest is concerned, Mr. Steele was widely and most favorably known by almost every one connected with it. Looked up to and respected by all, there are none who will not feel that a strong man has gone from amongst us. Strong because he was honest, true and faithful; strong because he was ever kindly disposed to every one whose effort was to do right; strong because he was uncompromising in his condemnation of everything that was mean, wrong or dishonest.

Born in 1804, at New Haven, Conn., at the age of 15 he came to New York, where he served an apprenticeship at the bookbinder's trade, and afterward completed his education at Norwalk, Conn. In 1827 he settled in Buffalo, where he became a successful business man, and identified himself with

the public interests of the place, serving in many public capacities. In the year 1847 the city of Buffalo was lighted with about 60 oil lamps. Then, as now, many and bitter complaints were uttered against the street lighting. Mr. E. G. Spaulding, the present President of the gas company was mayor, and Mr. Steele, as one of the aldermen, was chairman of the committee on lamps. They resolved to form a gas company, but there was no law under which they could organize. During that winter Mr. Steele went to Albany, and presented to the Legislature a draft of a general law under which companies might organize for the purpose of making and selling gas. The bill was passed substantially as Mr. Steele had drawn it, and remains to-day as the law under which the gas companies of this State are organized. He returned to Buffalo and organized the first company under the general law, and was elected secretary of the company, which position he has held ever since. Work was pushed vigorously, and in November, 1848, the oil lamps were replaced by gas, and private consumers were able to enjoy the luxury of gas light.

Thus for thirty-one years has Mr. Steele been identified with the gas interests of the country. Few managers can date their beginning of service so far back as this. Whatever Mr. Steele undertook was very apt to be successful, and his gas management was no exception; and, in his declining years, he had the satisfaction of seeing his company one of the strongest in the land. The American Gas Light Association has lost one of its oldest and best members. His absence will be felt for his genial good nature, his sound common sense, and his clear, practical expression of just what he honestly thought, ever made his presence a pleasure and a tower of strength.

In all the walks of life he seems to have been beloved. His noblest monument will be his good works and the memory of his integrity.

GEORGE W. EDGE.

Mr. Edge was born in Jersey City, New Jersey, February 22d, 1811, and died January 1st, 1880. His parents were

Isaac and Frances Edge, who settled in Jersey City in the year 1804.

Early in life Mr. Edge studied and became an expert in the science of chemistry, which afterwards, in his business as a gas engineer, was of great service to him. In the year 1852 he was waited upon by parties owning the gas works in Jersey City, and asked to become their manager and engineer. After many misgivings as to his ability to manage a gas works, he accepted the proposal and entered upon the duties, which only ceased with his life.

When Mr. Edge commenced his labors as a gas engineer, clay retorts were not used in this country, the retorts being of cast-iron set in benches of threes, and supported on bars of cast-iron, in some cases extending entirely across the bench, in other settings the bearing bars extended from a brick pier carried up to the necessary height, and were placed under one retort only. Plates of cast-iron were used to protect the batteries of the retorts from the heat, and the whole arrangement of the bench was in a crude state. The works were found entirely out of order, and the supply of gas to the consumers was very irregular. This state of affairs was very unpleasant to Mr. Edge, and not profitable to the company. Mr. Edge's ingenious mind soon devised a plan of relief from this condition, and as soon as the necessary material could be procured he energetically had carried out alterations and improvements which prevented any future difficulty in the supply of gas to the consumers. At the same time the improvements were a source of much profit to the company. During the time that Mr. Edge was engaged as a manager of gas works his mind was constantly occupied with plans for the improvement of the apparatus used, and for a more perfect system for the economical production and distribution of gas.

The results of his study he practically applied; and it is not too much to say that many gas engineers in this country have been instructed by advising with him. It is certain that many companies, both in this country and abroad, have profited by the use of apparatus designed and improved by him.

Mr. Edge was always ready to impart his knowledge to

others, and it seemed to give him much pleasure to meet with those of his profession, and to speak and advise in reference to the theory and practice of the manufacture of gas.

Mr. Edge's modest estimate of his abilities, as evinced by his diffidence in accepting the position of the engineer of the Jersey City Gas Company, and of other positions that were forced upon him, was a characteristic trait of the man, fully recognized by his friends. He was a man of marked ability, but extremely modest in claiming recognition for his inventions and services.

Mr. Edge was not only widely known as a gas engineer, but was known at home, in Jersey City, as a leading man, a good citizen, a warm friend, and wise counsellor. He has left an enviable reputation as a consolation for his relatives and friends.

KERR MURRAY.

Mr. Murray was born in Lanton, near Kelso, Scotland, July 10th, 1826, and died in Fort Wayne, Indiana, May 6th, 1880, at the age of fifty-three years, three months and twenty-six days. It was in the year 1868 when he first commenced the business of manufacturing for gas works, and since that time his trade steadily increased, until he enjoyed business relations with corporations and individuals throughout this country, and even extended to his native land. His specialty was steam engines and gas machinery, and during the fall of 1879 had supplied two cities in Colorado with gas works complete, besides furnishing apparatus to corporations in Missouri and Texas.

He was a man whose integrity has never been questioned; nor was he ever known to do a dishonorable action. His great skill as a mechanic made him successful in his various undertakings.

Personally, few men had a kinder heart, and his friends were only numbered by his acquaintances.

His death is not only a great loss to his family, but to the gas fraternity at large, as his guiding hand and counsel will be missed in many an enterprise.

JOHN C. BUXTON

died July, 1880, after a life numbering 52 years of useful, active work, leaving a record of singular worth and high integrity. His business record in Springfield, Ohio, covering more than a quarter of a century, bears trace of an upright, Christian gentleman. His employments were various, and all honorably filled. In 1865 he first entered the office of the gas company, and through his skilled, financial management of its affairs placed it in the front rank of successful institutions. While not claiming to be a gas engineer, his natural business capacity, diligence, and self-control in emergencies rendered him as successful in the management of the works as he was in the exacting details of office affairs.

In social life he was kindly and tender in feeling, unassuming in demeanor, with a strong love for the charms of home life. He will be missed in the various walks of life, leaving them all so much the debtor for his manly ways. His charity was unostentatious; his sympathy quick and tender; his relief flowed in many channels, leaving grateful memories, that follow his passing with prayerful interest.

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THEOBALD FORSTALL .	NEW ORLEANS, LA.
WM. A. STEDMAN . .	NEWPORT, R I.

SECRETARY AND TREASURER.

WM. HENRY WHITE .	NEW YORK CITY.

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A. B. SLATER . . .	PROVIDENCE, R I.
GEORGE S. HOOKEY . .	AUGUSTA, GA.

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T. LITTLEHALES . .	HAMILTON, CANADA.
SAM'L PRICHITT . . .	NASHVILLE, TENN.

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JAMES M. STARR . .	RICHMOND, IND.
P. T. BURTIS . . .	CHICAGO, ILL.
GEO. S. HOOKEY . .	AUGUSTA, GA.

LIST OF MEMBERS.

HONORARY MEMBERS.

Prof. C. F. CHANDLER, of Columbia College School of Mines, N. Y. City.

GEO. WARREN DRESSER, Editor "American Gas-Light Journal," N. Y. City, N. Y.

EMILE DURAND, Editor "Le Gas," Paris, France.

WILLIAM KING, Engineer Gas Works, Liverpool, England.

W. W. GREENOUGH, Agent and Treas. of Boston Gas-Light Company, Boston, Mass.

Prof. HENRY MORTON, Ph. D, Stevens Institute, Hoboken, N. J.

GEN. CHAS. ROOME, Pres't Manhattan Gas-Light Co., N. Y. City.

ACTIVE MEMBERS.

Africa, J. Simpson,	Huntingdon, Pa.
Allen, Augustus L.,	Poughkeepsie, N. Y.
Allen, Horatio P.,	New York City.
Allyn Horace A.,	Cambridge, Mass.
Allmand, Charles S.,	Norfolk, Va.
Andrew, John,	Chelsea, Mass.
Archer, B. F.,	Camden, N. J.
Attrill, Henry Y.,	New York City, N. Y.
Averill, A. T.,	Cedar Rapids, Iowa,
Avery, A. J.,	Dunkirk, N. Y.
Balmore, John,	New York City.
Bates, John W.,	Hoboken N. J.
Bates, T. A.,	Evansville Ind.
Barret, A. H.,	Louisville, Ky.
Battin, Isaac,	Albany, N. Y.
Baumgardner, J. H.,	Lancaster, Pa.
Baxter, William H.,	Petersburg, Va.
Beal, William R.,	New York City, N. Y.
Benson, Fred S.,	Brooklyn, N. Y.
Bill George D.,	Malden, Mass.
Borgner, C.,	Philadelphia, Pa.
Bradley, Wm. H.,	Brooklyn, E. D., N. Y.
Breese, E. M.,	Detroit, Mich.
Brooke, H. A.,	Albany, N. Y.
Brown, Thomas R.,	Philadelphia, Pa.
Budd, Henry,	Philadelphia, Pa.
Burtis, P. T.,	Chicago, Ill.
Butterworth, Thomas,	Rockford, Ill.
Butler, Eli,	West Meriden, Conn.
Cabot, George D.,	Lawrence, Mass.
Cadwell, William D.,	Nashua N. H.
Cartwright, Henry,	Philadelphia, Pa.
Cartwright, John,	Fishkill-on-Hudson, N. Y.
Cartwright, Matt,	Rochester, N. Y.
Cartwright, William,	Oswego, N. Y.
Cathels, E. S.,	Three Rivers, Quebec.
Caughey, Miles W.,	Erie, Pa.
Chambers, John S.,	Trenton, N. J.
Clark, Elmer W., Jr.,	Philadelphia Pa.
Cochrane, C. W.,	Gloucester, Mass.
Coggshall, H. F.,	Fitchburg, Mass,
Coldren, I. N.,	Iowa City, Iowa.
Collins, C.,	Chicago, Ill.
Coombs, Moses, Jr.,	Youngstown, Ohio.
Condict, J Elliott,	Philadelphia, Pa
Cornell, Thomas C.,	Yonkers, N. Y.
Cowing, John H.,	Buffalo, N. Y.
Crafts, David W.,	Northampton, Mass.
Crenshaw, N. B.,	Philadelphia, Pa.
Curley, Thos.,	Wilmington, Del.
Cushing, O. E.,	Lowell, Mass.
Davis, F. J.,	Waltham, Mass.
Denniston, W. H.,	Pittsburg, Pa.
Diall, M. N.,	Terre Haute, Ind.
Dickey, Samuel A.,	Dayton, Ohio.
Dittmar, Justice,	Willimsport, Pa.
Dock, Gilliard,	Harrisburg, Pa.
Dunbar, William,	New Albany, Ind.
Durfee, William B.,	Fall River, Mass.
Dwight, George,	Springfield, Mass.
Edgerton, H. H.,	Fort Wayne, Ind.
Farmer, William,	New York City, N. Y.
Fish, H. H.,	Utica, N. Y.
Flemming, D D.,	Jersey City, N. J.
Floyd, James R.,	New York City, N. Y.
Fodell, W. P.,	Philadelphia, Pa.
Forstall, Theobald,	New Orleans, La.
Fox, David H.,	Reading, Pa.
Fowler, John,	Philadelphia, Pa.
Frost, W H.,	Plymouth, Mass.
Fuller, H M.,	Greenville, Mich.
Gardner, William,	Pittsburg, Pa.
Gates, Frederick W.,	Hamilton, Ontario
Gerdenier, Charles A.,	Bridgeport, Conn.
Gerould, H. T.,	Cairo, Ill.
Gerould, L. P.,	Newton, Mass.
Gibson, William,	Cambridge, Mass.
Gilbert, Thomas D.,	Grand Rapids, Mich.
Gill, J. Pearson,	42 Pine St., N. Y. City.
Goodwin, W. W.,	Philadelphia, Pa.
Gray, C. E.,	Hannibal, Mo.
Green, John,	Portland, Oregon.
Greenough, Malcom S.,	Boston, Mass.
Griffen, J J.,	Philadelphia, Pa.
Guerard, A. G.,	Savannah, Ga.
Hanford, L. C.,	Norwalk, Conn.
Harbison, John P.	Hartford, Conn.
Harrington, M.,	Niagara Falls, N. Y.
Heilman, William,	Evansville, Ind.
Helme, William,	Philadelphia, Pa.
Hendly, Joseph,	Beloit, Wis.
Herzog, I.,	New York City, N. Y.
Hickenlooper, A.	Cincinnati, Ohio.
Hookey, George S.,	Augusta, Ga.
Hopper, Thomas C.,	Philadelphia, Pa.,
How, James,	Brooklyn, N. Y.
Howard, L. J.,	St. Louis, Mo.
Humphreys, Alexander C.,	Bergen Point, N. J.
Humphreys, William,	Dansville, N Y.
Isbell, Charles W.,	New York City, N. Y.
James, Charles E.,	Chattanooga, Tenn.
Jones, E. C.,	So. Boston, Mass.

Jones Edward, Boston, Mass.
Jones, M. H., Easton, Penn.
Keith, Edwin, Taunton, Mass.
Kerr, John, Kingston, Ontario.
King, E. J., Jacksonville, Ill.
King, Joseph O., Jacksonville, Ill.
Kingsbury, F. D., Corning, N. Y.
Knowles, J. H., Richmond, Va.
Kraft, Geo. W., Philadelpia, Pa.
Lehman, B. E., Bethlehem, S., Pa.
Lever, Charles, Flushing, N. Y.
Lindsley, Edward, Cleveland, Ohio.
Linton, J., Ravenna, Ohio.
Linton, W. H., Ravenna, Ohio.
Littlehales, T., Hamilton, Ontario.
Ludlam, Edwin, Brooklyn, N. Y.
Maurice, C. F., Sing Sing, N. Y.
McCauley, L. G., Westchester, Pa.
McDonald, Wm., Albany, N. Y.
McElroy, John H., Pittsburg, Pa.
McIlhenny, Geo. A., Washington, D. C.
McIlhenny, John, Philadelphia, Pa.
McMillin, Emerson, Ironton, Ohio.
Merrifield, P. S., Troy, N. Y.
Merrill, Hiram, Janesville, Wis.
Merrimon, James D., Pictou, Nova Scotia.
Merritt, C. H., Danbury, Conn.
Miller, W. H., Columbus, Ohio.
Monks, Richard J., Boston, Mass.
Moore, E. D., Circleville, Ohio.
Morris, H. G., Philadelphia, Pa.
Moses, G. W., Chelsea, Mass.
Moss, Lewis, Sandusky, Ohio.
Munzinger, P., Philadelphia, Pa.
Murphy, Hugh, Sing Sing, N. Y.
Neal, George B., Charlestown, Mass.
Nettleton, Charles, New York City, N. Y.
Nettleton, Charles, H., Derby, Conn.
Newell, John W., New Brunswick, N. J.
Norton A. M., Nashua, N. H.
Odiorne, F. H., Boston, Mass.
Page, Geo. S., New York City.
Parkhurst, J. G., Coldwater, Mich.
Parritt, Willard, Bloomington, Ill.
Patton, J. Desha, Hicksville, Ohio.
Pearson, W. H., Toronto, Ontario.
Peebles, Philip, Quebec, Quebec.
Perry, Albert D., Portsmouth, Va.
Pishon, T. J., Roxbury, Mass.
Poland, William, Chillicothe, Ohio.
Pratt, J. C., Jamaica Plains, Mass.
Price, W. H., Cleveland, Ohio.
Prichitt, Samuel, Nashville, Tenn.
Printz, Eugene, Zanesville, Ohio.
Ramsdell, Geo. G., Vincennes, Ind.
Rankin, Benjamin, Louisville, Ky.
Raynor, Charles H., Adrian, Mich.
Reed, George K., Lancaster, Pa.
Reinmund, H. J., Lancaster Ohio.
Rice, E. S., Logansport, Ind.
Richardson, A. W., North Adams, Mass.
Richardson, George, Wilmington, Del.
Rogers, James F., Jamaica Plain, Mass.
Rollins, J. H., Worcester, Mass.
Root, F. M., Connersville, Ind.
Roxbury, Jacob, Alexandria, Va.
Sabbaton, F. A., Troy, N. Y.
Salmon, Patrick J., Athlone, Ireland.
Scott, Isaac R., Waltham, Mass.
Sherman, F. C., New Haven, Conn.
Sibley, H. H., St. Paul, Minn.
Slater, A. B., Providence, R. I.
Sloane, T. O'Connor, Brooklyn, N. Y.
Smalley, Andrew A., Newark, N. J.
Smith, C. F., Marlboro, Mass.
Smith, James H., Newark, Ohio.
Smith, Marcus, Wilkesbarre, Pa.
Somerville, James, Indianapolis, Ind.
Spaulding, C. F., Brookline, Mass.
Spaulding, E. G., Buffalo, N. Y.
Spencer, R., Burlington, Iowa.
Spear, J. Q. A., Dorchester, Mass.
Stacey, F. A., Chillicothe, Ohio.
Stacey, Henry, Indianapolis, Ind.
Stanley, I. N., Brooklyn, N. Y.
Starr, James M., Richmond, Ind.
Stedman, William A., Newport, R. I.
Stephens, Thodore B., Tarrytown, N. Y.
Sterling, J. M., Monroe, Mich.
Stiness, Samuel G., Pautucket, R. I.
Swain, R. B., Cape May, N. J.
Terry, R. C., Philadelphia, Pa.
Turner, Thomas, Charleston, S. C.
Turner, W. H., Rondout, N. Y.
Van Benschoten, Charles C., New Rochelle, N. Y.
Vanderpool, Eugene, Newark, N. J.
Warmington, George H., Cleveland, O.
Watkins, E. T. Chicago, Ill.
Weare, C., Marshaltown, Iowa.
Weber, Adam. New York City.
Wells, George H., Nashville, Tenn.
White, C. A., Rochester, N. Y.
White, E. V., Portsmouth, Va.
White, T. F., Houston, Texas.
White, W. Henry, Brooklyn, N. Y.
Whitestone, Henry, Louisville, Ky.
Williams, James Johnstown, Pa.
Williams, William L., Paterson, N. J.
Wood, Austin C., Syracuse, N. Y.
Wood, Edward L., Lewiston, Me.
Wood, Gideon, New Bedford, Mass.
Young, Robert, Allegany City, Pa.
Zollikoffer, O. New York City, N. Y.

CONSTITUTION

OF THE

AMERICAN GAS LIGHT ASSOCIATION.

I. The name of this Association shall be THE AMERICAN GAS LIGHT ASSOCIATION, and its office shall be in the City of New York.

II. The objects of this Association shall be—the promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and management of gas works, and the manufacture, distribution and consumption of illuminating gas, to the end that its cost may be cheapened and its consumption increased.

2. The establishment and maintenance of a spirit of fraternity between the members of the Association, by social intercourse, and by friendly exchange of information and ideas on the before-mentioned subject matters.

3. The inducement and extension of more cordial and frienly relations between the manufacturers of illuminating gas and their patrons, based upon mutuality of interests and a recognition by both of the fact that each have rights which the other should respect.

III. The members of this Association shall consist of two classes, active members and honorary members.

IV. *To be eligible as an active member a person must be a president, vice-president, director, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works, or a person practically skilled in the construction and management of gas works.*

V. Honorary members shall be gentlemen whose scientific or practical knowledge in matters relating to the gas industry, and whose efforts and interest in that behalf shall recommend them to the Association.

VI. Every applicant for active membership shall signify the same in writing to the secretary, addressed to the Association, indorsed by two active members.

VII. Honorary members shall be proposed to or by the Executive Committee, and notice thereof shall be given by the Secretary to the Association for its action. The election of applicants for active membership, and of persons proposed as honorary members, shall be by ballot, and each person shall receive two-thirds of the vote cast to be elected.

VIII. New members shall be formally introduced to the Association by the presiding officer after being elected, when they shall subscribe their names to the Constitution of the Association in a roll book of the same, and they shall each, at the same time, receive a copy of the Constitution and By-Laws of the Association.

IX. If any applicant for membership or person proposed for membership, on being balloted for, be rejected, no notice shall be taken of the application, or action on the same, in the minutes.

X. The affairs of the Association shall be managed by an Executive Committee, subject to the control of the Association, by its action in general meetings. The Executive Committee shall be composed of the officers of the Association for the time being, and the President or Acting President for the last preceding year. All questions in Executive Committee shall be decided by a majority vote, and five members shall be a quorum.

XI. The officers shall consist of a President, three Vice-Presidents, Treasurer and Secretary, to be elected annually, by ballot, six members of Executive Committee, and three mem-

bers of Finance Committee. "And that a change of at least one vice-president, one member of the finance committee, and two members of the executive committee, be made at each annual meeting of the Association."

XII. The officers of the Association shall assume office immediately after the close of the meeting at which they are elected; they shall hold meetings at the call of the President, or in his absence, at the call of the Vice-President, and make arrangements for carrying out the objects of the Association.

XIII. The President, or in his absence, one of the Vice-Presidents, shall preside at all meetings of the Association and Executive Committee at which he is present.

XIV. The duties of the Treasurer shall be to receive and safely keep all annual dues and funds of the Association; to keep correct accounts of the same, and pay all bills approved by the President or a member of the Finance Committee; and he shall make an annual report to be submitted to the Association.

XV. The duties of the Secretary shall be to take minutes of all proceedings of the Association, and of the Executive Committee, and enter them in proper books for the purpose. He shall conduct the correspondence of the Association; read minutes and notices of all the meetings, and also papers and communications, if the authors wish it, and perform whatever duties may be required in the Constitution and By-laws appertaining to this department.

XVI. The Finance Committee shall meet on the day of each annual meeting of the Association, at least one hour befure the opening of the meeting, to receive from the Treasurer a statement of his accounts, and audit the same. They shall hold such other meetings from time to time as the interests of the Association may require.

XVII. The annual meeting of the Association shall be held on the third Wednesday of October of each year, at 10 o'clock A. M., at such place as shall be designated by the Association at the previous annual meeting.

XVIII. At the annual meeting of the Association the order of business shall be :

1. The reading of the minutes of the last meeting.

2. The reading of applications, notices and reports for new membership.

3. The election and introduction of new members.

4. The address of the President.

5. The report of Executive Committee on the management of the Association during the previous year.

6. The report of the Treasurer.

7. The report of the Finance Committee.

8. Reports of special committees.

9. The election of officers.

10. The reading of papers, of which notice has been given to members by the Secretary, and discussions upon the same.

11. General business.

XIX. At other general meetings of the Association, the order of business shall be the same except as to the 5th, 6th, 7th and 9th clauses.

XX. The Secretary shall send notices to all members of the Association at least fourteen days before each general meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

XXI. The Executive Committee shall meet one hour before each general meeting of the Association, and on other

occasions when the President shall deem it necessary; of which special meetings reasonable notice shall be given, by special call in print or writing, specifying the business to be attended to.

XXII. All questions shall be decided by any convenient system of open voting, the presiding officer to have a second or casting vote when necessary.

XXIII. Questions of special nature shall be decided by ballot.

XXIV. Any member with the concurrence of the presiding officer, may admit a friend to each meeting of the Association, but such person shall not take any part in the discussion unless permission to do so be given by the meeting.

XXV. All papers read at the meetings of the Association must relate to matters either directly or indirectly connected with the objects of the Association, and must be approved by the Executive Committee before being read.

XXVI. All papers, drawings or models submitted to the meeting of the Association shall be and remain the property of the authors.

XXVII. *Active members shall pay an initiation fee of ten dollars, and the sum of five dollars annually thereafter, which shall be paid in advance.*

XXVIII. No member who shall be two years in arrears shall be entitled to vote, or to participate in the deliberations of the Association.

XXIX. Honorary members shall not be required to make any payments or contributions to the Association.

XXX. Any member may retire from membership by giving written notice to that effect to the Secretary, and the payment of all annual dues to that date, unless released from said pay-

ment by a vote of the Executive Committee. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by vote of the Executive Committee.

XXXI. Any member may compound for his annual payments by paying fifty dollars in one sum.

XXXII. A member may be expelled from the Association by a report and motion to that effect made by the Executive Committee, at any general meeting of the Association; the vote shall be by ballot, and shall require two-thirds of the vote cast for its adoption.

AMENDMENTS.

XXXIII. All propositions for adding to or altering any of the provisions of the foregoing Constitution, shall be laid before the Executive Commlttee, who may bring it before the next general meeting of the Association, if they think fit, and such Committee shall be bound to do so on the requisition in writing of any five members of the Association. Each member of the Association shall, upon request, be furnished by the Secretary with a copy of the Constitution and By-Laws of the Association, and also a list of the names and residences of the members.

REPORT OF THE TREASURER

OF THE

AMERICAN GAS-LIGHT ASSOCIATION,

For the Year ending September 30, 1879.

CHARLES NETTLELON, *Treasurer*,

In account with AMERICAN GAS-LIGHT ASSOCIATION.

1878.		Dr.	
October 17.	To Cash	balance on hand........................	$624 60
	" "	F. A. Stacey, Initiation fee..................	10 00
	" "	C F. Spaulding, "	10 00
	" "	M. S. Greenough, "	10 00
	" "	Horace A. Allyn, "	10 CO
	" "	T. O'C. Sloane, "	10 00
	" "	Chas. Lever, "	10 00
	" "	A. H. Barret, "	10 00
	" "	G. D. Bill, "	10 00
	" "	E. V. White, "	10 00
	" "	James D. Merrimon "	10 00

ANNUAL DUES.

To Cash,	C. S. Allmand........................	1879	5 00
" "	Jno. Andrews........................	"	5 00
" "	Jno. Balmore........................	"	5 00
" "	Isaac Battin	"	5 00
" "	Wm. H. Bradley......................	"	5 00
" "	Wm. R. Beal..........................	1878	5 00
" "	Wm R. Beal...........................	1879	5 00
" "	Jno. W. Bates	"	5 00
" "	Geo. D. Cabot	"	5 00
" "	Matt. Cartwright....................	"	5 00
" "	H. F. Coggshall......................	"	5 00
" "	O. E. Cushing........................	1878	5 00
" "	O. E. Cushing........................	1879	5 00
" "	Jno. H. Cowing......................	"	5 00
" "	N. B. Crenshaw	"	5 00
" "	Henry Cartwright....................	"	5 00

October 17.	To Cash,	John Cartwright	1879	$5 00
"	"	Thos. C. Cornell	"	5 00
"	"	Wm. Cartwright	"	5 00
"	"	W. H. Denniston	"	5 00
"	"	George Dwight	1878	5 00
"	"	George Dwight	1879	5 00
"	"	F. J. Davis	"	5 00
"	"	M. N. Diall	"	5 00
"	"	H. H. Edgerton	1877	5 00
"	"	H. H. Edgerton, on account	1878	2 00
"	"	F. W. Gates	1879	5 00
"	"	L. P. Gerould	"	5 00
"	"	Chas. A. Gerdenier	"	5 00
"	"	Wm. W. Goodwin	"	5 00
"	"	H. T. Gerould	"	5 00
"	"	John P. Harbison	"	5 00
"	"	L. C. Hanford	"	5 00
"	"	A. C. Humphreys	"	5 00
"	"	Wm. Helme	"	5 00
"	"	Geo. S. Hookey	"	5 00
"	"	Jos. Hendley	"	5 00
"	"	I. Herzog	"	5 00
"	"	Thos. C Hopper	"	5 00
"	"	M. Harrington	"	5 00
"	"	T. Littlehales	"	5 00
"	"	Jno. McIlhenny	"	5 00
"	"	C. F Maurice	"	5 00
"	"	Lewis Moss	"	5 00
"	"	W. H. Miller	"	5 00
"	"	Geo. A. McIlhenny	"	5 00
"	"	Jno. H. McIlroy	"	5 00
"	"	Geo. B. Neal	"	5 00
"	"	C. H. Nettleton	1878	5 00
"	"	" "	1879	5 00
"	"	Chas. Nettleton	"	5 00
"	"	" "	1878	5 00
"	"	F. H. Odiorne	1879	5 00
"	"	T. J. Pishon	"	5 00
"	"	Sam'l Pritchitt	"	5 00
"	"	A. D. Perry	"	5 00
"	"	A. D. Perry	1878	5 00
"	"	W. H. Pearson	1879	5 00
"	"	W. H. Price	"	5 00
"	"	J. H. Rollins	"	5 00
"	"	Chas. Roome	"	5 00
"	"	Geo. Richardson	"	5 00

October 17.	To Cash,	Jas. F. Rogers	1879	$5 00
	" "	A. B. Slater	"	5 00
	" "	Marcus Smith	"	5 00
	" "	Isaac R. Scott	1878	5 00
	" "	" " "	1879	5 00
	" "	Jas. M. Starr	"	5 00
	" "	F. C. Sherman	"	5 00
	" "	Henry Stacey	"	5 00
	" "	Wm. A. Stedman	"	5 00
	" "	Thos. Turner	1879	5 00
	" "	R. C. Terry	"	5 00
	" "	C. C. Van Benschoten	"	5 00
	" "	C. A. White	"	5 00
	" "	Wm. Henry White	"	5 00
	" "	A. C. Wood	"	5 00
	" "	T. F. White	"	5 00
	" "	Geo. H. Wells	"	5 00
	" "	Robt. Young	"	5 00
	" "	Oscar Zollikoffer	"	5 00
Nov. 19.	" "	Pat'k J. Salmon	"	5 00
Dec. 16.	" "	E. M. Breese	"	5 00
30.	" "	G. H. Warmington	"	5 00
	" "	Edward Lindsley	"	5 00
Aug. 25.	" "	H. P. Allen	1879	5 00
	" "	Geo. W. Edge	"	5 00
26.	" "	Edwin Keith	"	5 00
	" "	Edwin Ludlam	"	5 00
	" "	John W. Newell	"	5 00
27.	" "	Edward Jones	"	5 00
	" "	W. D. Cadwell	"	5 00
	" "	T. F. Rowland	"	5 00
	" "	T. D. Gilbert	"	5 00
	" "	Jos. O. King	"	5 00
	" "	Moses Coombs, Jr	"	5 00
28.	" "	E. T. Watkins	1878	5 00
	" "	" "	1879	5 00
29.	" "	R. J. Monks	"	5 00
	" "	Sam'l A. Dickey	"	5 00
	" "	Wm. G. Gardiner	"	5 00
30.	" "	Wm. B. Durfee	"	5 00
	" "	F. A. Sabbatton	"	5 00
	" "	Miles W. Caughey	"	5 00
	" "	Philip Peebles	"	5 00
Sept. 1.	" "	J. Desha Patton	"	5 00
	" "	Thos. R. Brown	"	5 00
	" "	Willard Parritt	"	5 00

Sept.	1.	To Cash,	Willard Parritt	1880	$5 00
		" "	Theo. Forstall	1879	5 00
		" "	" "	1880	5 00
	2.	" "	H H. Fish	1878	5 00
		" "	" "	1879	5 00
	3.	" "	Edward L. Wood	"	5 00
	3.	" "	Justus Ditmar	"	5 00
	4.	" "	Dorchester Gas Light Co.	"	5 00
		" "	Jas. Somerville	"	5 00
		" "	R. Spencer	"	5 00
		" "	Wm. L. Williams	"	5 00
	5.	" "	Thos. R. Butterworth	"	5 00
	8.	" "	Jno. C. Buxton	"	5 00
		" "	A. G. Guerard	"	5 00
		" "	San Antonio Gas Light Co.	1876	5 00
		" "	" " " " "	1877	5 00
		" "	" " " " "	1878	5 00
	9.	" "	Wm. Farmer	1879	5 00
		" "	Andrew A. Smalley, Initiation fee	"	10 00
		" "	Hnnry Y. Attrill, " "	"	10 00
	10.	" "	T. A. Bates	"	5 00
		" "	Eugene Vanderpool	"	5 00
	11.	" "	Jno. Kerr, Initiation fee	"	10 00
	12.	" "	Hiram Merrill	"	5 00
	16.	" "	John Green	"	5 00
	17.	" "	Eugene Printz	"	5 00
		" "	" " in advance	1880	5 00
		" "	Fred. S. Benson	1879	5 00
		" "	Gillard Dock	"	5 00
	18.	" "	J. Simpson Africa	"	5 00
		" "	Corning Gas Light Co.	"	5 00
	22.	" "	Augustus L. Allen	1877	5 00
		" "	" "	1878	5 00
		" "	" "	1879	5 00
	23.	" "	E. S. Cathels	1878	5 00
		" "	D. W. Crafts	1879	5 00
	25.	" "	Chas. E. James	"	5 00
	26.	" "	J. N. Coldren	"	5 00
		" "	" " in advance	1880	5 00
		" "	Robt. Young	"	5 00
		" "	Jas. Williams	1878	5 00
		" "	" "	1879	5 00
	29.	" "	Theo. B. Stephens	1878	5 00
		" "	" "	1879	5 00
		" "	James R. Floyd	"	5 00
					$1,501 60

1878.		Cr.	
October 22.	By Cash,	Postage stamps	$3 00
	" "	Rent Fifth Ave. Hall for meeting	60 00
1879.			
August 12.	" "	E. P. Coby & Co., receipt book	9 00
	" "	" " " storage of Vol. II., Proceedings	5 00
	" "	" " " insurance of do.	4 25
13.	" "	Express charges	50
23.	" "	Postage stamps	10 00
Sept. 24.	" "	Salary—secretary and treasurer	300 00
30.	" "	Postage stamps	10 00
	" "	Postal cards	2 00
	By Balance		1,097 85
			$1,501 60

We, the undersigned, have examined the accounts of Mr. Charles Nettleton, treasurer, for the year ending September 30th, 1879, and find the same correct, with a balance in the treasurer's hands of ten hundred and ninety-seven 85-100 dollars ($1,097 85).

(Signed) JNO. S. CHAMBERS,
JNO. P. HARBISON,
Finance Committee.

REPORT OF THE TREASURER

OF THE

AMERICAN GAS-LIGHT ASSOCIATION,

For the Year ending September 30, 1880.

WM. HENRY WHITE, *Treasurer*,

In account with the AMERICAN GAS-LIGHT ASSOCIATION.

1879.		Dr.		
October 1.	To Cash	balance on hand		$1,097 85
	" "	Wm. H. Baxter,	1879	5 00
6.	" "	O. G. Steele,	1880	5 00
7.	" "	James How,	1879	5 00
9.	" "	Chas. W. Isbell,	"	5 00
	" "	L. G. McCauley,	"	5 00
11.	" "	A. J. Avery,	1878	5 00
	" "	" "	1879	5 00
	" "	M. H. Jones,	"	5 00
	" "	Geo. K. Reed,	"	5 00
	" "	E. D. Moore,	"	5 00
	" "	Benjamin Rankin,	"	5 00
	" "	" "	1880	5 00
	" "	One copy, Vols. I. and III.		3 00
	" "	Kerr Murray,	1879	5 00
13.	" "	Wm. Humphreys,	1877	5 00
	" "	" "	1878	5 00
	" "	" "	1879	5 00
	" "	C. E. Gray,	"	5 00
	" "	C. H. Raynor,	1878	5 00
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	" "	" "	1879	5 00
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August 23.	To Cash,	Sam'l A. Dickey	1880	$5	00
	" "	Moses Coombs, Jr.	"	5	00
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27.	" "	T. Littlehales	"	5	00
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	" "	Hiram Merrill	"	5	00
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	" "	Wm. R. Beal..	1877	5	00
	" "	" "	1880	5	00
	" "	Interest on deposits to July 1	"	22	50

1879. Cr.

October 25.	By Cash,	publication of Vol. III. Proceedings	$676	75
28.	" "		13	co
30.	" "	Postage stamps	6	46
	" "	Wrapping paper	1	25
Nov. 1.	" "	Cartage of books	1	50
	" "	Ball of twine		25
3.	" "	Rubber stamps	2	25
	" "	Postage stamps	36	40
5.	" "	Express charges		50
6.	" "	Copying tablet and ink for same		35
Dec. 13.	" "	Postage stamps	1	50
	" "	Cash book	2	25
18.	" "	Pamphlets, " Use of Gas for Cooking "	6	00
	" "	Envelopes for same		60

1880.				
July	8.	By Cash,	Postage	$1 50
Aug.	7.	" "	H. M. Gardner, printing notices	5 25
	10.	" "	Postage and postal cards	6 50
	20.	" "	Express	25
	31.	" "	A. M. Callender, printing	4 50
Sept.	25.	" "	' " "	2 00
	30.	" "	H. M. Gardner	3 00
		" "	Postage, telegram and postal cards	4 75
		" "	Envelopes and stylograph	6 00
		" "	Salary—secretary and treasurer	300 00
		By balance		1,113 54
				$2,196 35

We, the undersigned, have examined the accounts of Wm. Henry White treasurer, for the year ending September 30th, 1880, and find the same to be correct, with a balance in the treasury of eleven hundred and thirteen 54-100 dollars ($1,113 54).

(Signed) JOHN S. CHAMBERS,
A. B. SLATER,
THEO. FORSTALL,
Finance Committee.